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# Society of Economics and Development

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3. To promote economic prosperity and serve as a tool to create the consciousness for development.
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CNKI Scholar	<a href="http://www.eng.scholar.cnki.net">www.eng.scholar.cnki.net</a>
Directory of Research Journals Indexing	<a href="http://www.drji.org">www.drji.org</a>
Directory of Science	<a href="http://www.directorofscience.com">www.directorofscience.com</a>
Diva Enterprises Private Limited	<a href="http://www.indianjournals.com">www.indianjournals.com</a>
Emerging Sources Citation Index (Thomson Reuters)	<a href="http://www.ip-science.thomsonreuters.com">www.ip-science.thomsonreuters.com</a>
Eurasian Scientific Journal Index	<a href="http://www.esjindex.org">www.esjindex.org</a>
General Impact Factor	<a href="http://www.generalimpactfactor.com">www.generalimpactfactor.com</a>
Global Impact Factor (2015: 0.435)	<a href="http://www.globalimpactfactor.com">www.globalimpactfactor.com</a>
Google Scholar	<a href="http://www.scholar.google.co.in">www.scholar.google.co.in</a>
Indian Science and Research	<a href="http://www.indianscience.in">www.indianscience.in</a>
Infobase Index	<a href="http://www.infobaseindex.com">www.infobaseindex.com</a>
Institute for Information Resources	<a href="http://www.rjifactor.com">www.rjifactor.com</a>
Impact Services for International Journals	<a href="http://www.ifsij.com">www.ifsij.com</a>
International Innovative Journal Impact Factor (IIJIF)	<a href="http://www.ijif.com">www.ijif.com</a>
International Institute of Organized Research (I2OR)	<a href="http://www.i2or.com">www.i2or.com</a>
International Impact Factor Services	<a href="http://www.impactfactorservice.com">www.impactfactorservice.com</a>
International Accreditation and Research Council	<a href="http://www.iarcif.org">www.iarcif.org</a>
International Society for Research Activity	<a href="http://www.israjif.org">www.israjif.org</a>
JIFACTOR	<a href="http://www.jifactor.org">www.jifactor.org</a>
J-Gate	<a href="http://www.jgateplus.com">www.jgateplus.com</a>
MIAR (Information Matrix for the Analysis of Journals)	<a href="http://www.miar.ub.edu">www.miar.ub.edu</a>
National Academy of Agricultural Sciences (NAAS score: 4.82)	<a href="http://www.naasindia.org">www.naasindia.org</a>
National Documentation Centre	<a href="http://www.eskep.ekt.gr">www.eskep.ekt.gr</a>
Pak Academic Research	<a href="http://www.pakacademicsearch.com">www.pakacademicsearch.com</a>
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## PREFACE

In an effort to boost agriculture sector, the Indian Government has set an ambitious goal to double farmers' income by 2022. During the run upto the Green Revolution, and thereafter, the emphasis was always on production and productivity. Enhancing farmers' income was not in focus per se. Our policies were usually farm centric and not farmer-centric. This is one of the reasons why there is farmers' distress despite the fact our country has achieved commendable position in food production. By and large, agricultural policies, their implementation, deep rooted corruption on service delivery, no effective contingency plan for bad weather, poor farm credit system, ineffective crop insurance, high input cost, poor market access, traders' dominated markets, lack of ware housing and storage facilities, discouraging minimum support price among various factors have played crucial role in pushing Indian agriculture into distress. There is a need to shift the focus from output to income of farmers and the need for an amalgam of good strategy, well designed programmes, adequate resources and good governance in implementation to realize the envisaged outcome. This can be achieved through increase in area under irrigation, provision of quality seeds and nutrients based on soil health, reducing post harvest losses through investment in warehousing and cold chains, food processing, creation of a national farm market, a new crop insurance scheme and promotion of ancillary activities such as poultry, bee keeping and fisheries. It is imperative to address the prevailing rural distress, mitigating the problem of rural unemployment and under employment. Fragmented holdings, land degradation, in adequate availability of certified seeds, inefficient water usage and imbalanced use of fertilizers add to the challenge. We need to think beyond food security and give back to our farmers a sense of income security. In order to achieves objective, we will have to devise micro level action plans to augment farmers' income from all sources and not only from crop production.

Keeping present scenario in view, the Society of Economic & Development has chosen the theme **Doubling Indian Farmers' Income by 2022: Opportunities & Challenges** for its 4<sup>th</sup> National Seminar being organized at Punjab Agricultural University, Ludhiana on April 07, 2017.

There has been an over whelming response from the researchers for the seminar and the Society appreciates and acknowledges the interest shown by the researchers. A total of 190 full research papers were received and 142 articles were selected after thorough screening, for presentation in the seminar and full papers are published in full in the Seminar issue of the Journal.

The Society is grateful to Dr. B.S. Dhillon, Vice Chancellor, Punjab Agricultural University, Ludhiana for giving his consent to host 4th National Seminar at PAU, Ludhiana and providing all the logistic support.

The financial help rendered by National Council of State Agriculture Marketing Board, New Delhi and Punjab Mandi Board, Chandigarh is gratefully acknowledged. The Society highly appreciates the continuous support extended by Mr S.S. Randhawa, Managing Director, COSAMB, New Delhi and Mr. Harpreet Singh Sidhu, General Manager, Punjab Mandi Board, Chandigarh. We are grateful to Dr. H.S. Dhaliwal, Director, Punjab Agricultural Marketing and Extension Training Institute, PAU Campus, Ludhiana for providing facilities for the Seminar.

The Society is grateful to Dr. Poonam Kataria, Professor of Economics, PAU, Ludhiana for taking the responsibility of Organizing Secretary, 4<sup>th</sup> National Seminar and Dr Sukhpal Singh, Professor and Head, Department of Economics and Sociology, Punjab Agricultural University, Ludhiana for his cooperation and support for organizing this seminar.

The Office Bearers of the Society of Economics and Development have contributed in several ways. I take this opportunity to thank all of them for the help and cooperation extended by them. I also gratefully acknowledge the untiring efforts of Dr. S.S. Chahal, Chairman, Editorial Committee of Seminar and all its members who have reviewed the articles submitted for the seminar. Their contribution to the enrichment of the Journal are thankfully acknowledged. Cooperation was also sought from the learned scientists in evaluating the papers received for presentation in the Seminar. I am grateful to all the reviewers for their support. I also thank all the authors who have contributed their excellent research work for presentation at this Seminar. Thanks are also due to their organizations for deputing them to the 4<sup>th</sup> National Seminar organized by Society of Economics & Development.

(Parminder Kaur)  
General Secretary

Date:



## **Framework for Doubling the Income of Wheat Producers' by 2022: Trends, Pathway and Drivers**

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### **ABSTRACT**

*Indian agriculture is at crossroads owing to the agrarian distress which manifests itself in various forms affecting farmers' welfare. The present paper tracks the trend in wheat producers' income between 2006-07 and 2013-14 followed by suggesting framework for doubling farmers' income (DFI) by 2022. Convergence between science & technology, institutions and policy with emphasis on potential drivers like productivity enhancement through improved genotypes coupled with adoption of cost reduction technologies, diversification, irrigation, price realisation under efficient markets, terms of trade, risk adaptation, public-private partnership, skilling and land use governed by strong policies and leadership at all levels will enable an environment for DFI.*

### **Keywords**

DFI, income doubling, institutions, policy, science and technology

### **JEL Codes**

C81, E64, O15, Q18, Y10

### **INTRODUCTION**

Indian agriculture is at crossroads since the recent farm crisis and agrarian distress resulting in an adverse impact on farmers' livelihood. Decline in farm productivity as well as income has a serious implication on rural household poverty, long-run sustainability and other social indicators (Timmer, 1995; Datt & Ravallion, 1998; Mellor, 1999; Fan *et al.*, 1999; Irz *et al.*, 2001; Minten & Barrett, 2008; Byerlee *et al.*, 2009; Muyaanga, *et al.*, 2010; Reganold *et al.*, 2011). Hence, increasing the farmers' income through concerted efforts at grassroot level has become an utmost priority for the agricultural researchers and policy planners. In the context, the Indian government in its budget (2016-17) proposed for doubling farmers' income (DFI) by 2022 through all potential pathways for addressing the twin wicked situation *viz.*, farm crisis and agrarian distress. Subsequently, a national level meet was organised to devise strategies in response to the Hon'ble Prime Minister's call to the nation (ICFA, 2016).

Despite the lack of farmers' income data series in India, it has been estimated from survey that the growth in farm income has witnessed a fall since 2011-12 and currently hovering around one per cent (Chand *et al.*,

2015). Statistics on real income across states in India reveal that barring Odisha, the rest have not experienced the doubling between 2003 and 2013 (Chandrasekhar & Mehrotra, 2016). However, in nominal terms the increase in income was more than three times, from ₹2115 (2003) to ₹6426 (2013). The share of farming in total income of land holders hovers around 48 per cent for the country as a whole. It ranges from as high as 86 per cent for cultivators having more than 10ha to 0.65 per cent in the case of farmers with less than 0.01ha. The other sources of income were wages, livestock and non-farm activities. Overwhelmingly, income from livestock has contributed significantly by more than three times in real terms to farmers' livelihood and shockingly non-farm income has remained almost same at national level and declined in a majority of the regions at varying magnitudes (Chandrasekhar and Mehrotra, 2016). Several other estimates have reported the state of affairs on farm income with a striking difference in figures regardless showing the same overall picture of the farm economy (Sen, 2016; Chand *et al.*, 2015; Birthal *et al.*, 2015; NABARD, 2015; Chand *et al.*, 2011; and NABARD, 2009). Annual farm income (per cultivator) between 1983-84 and 1993-94 witnessed an increase of 3.67 per cent (2.74 per cent),

dropped to 3.30 per cent (1.96 per cent) in the subsequent decade, and then increased to 5.36 per cent (7.29 per cent) during 2004–05 to 2011–12. Further, the total income shared between the cultivators and labourers during the past three decades was hovering around 80 and 20 per cent, respectively (Chand *et al.*, 2015) indicating the required thrust on farming activities for doubling the income.

Wheat is one of the important staples (critical staff of life) cultivated in around 30mha and accounts for about 37 per cent of the total foodgrains production. The cereal has the largest number of cultivators after rice and increasing their income becomes a major concern for the researchers, economists and policy planners owing to the 48 per cent share (Chandrasekhar and Mehrotra, 2016) by farming alone in total income. In the milieu, the present study is an attempt to decipher the possible pathway for doubling the income of wheat producers addressed by potential drivers. The spatial and temporal trends in income have been highlighted for better understanding the scenario, followed by suggesting a framework integrating science and technology, institutions, and policy to double the income as per the witnessed dynamics.

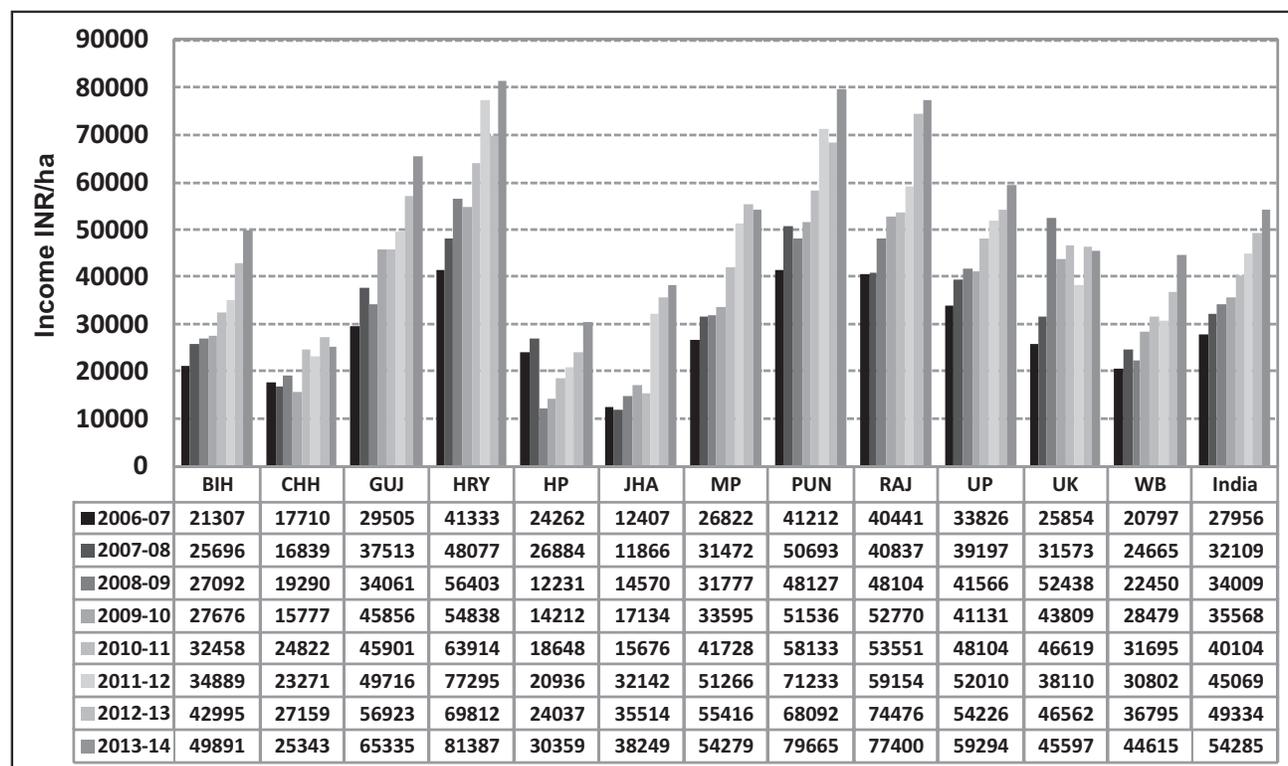
**DATA AND METHODOLOGY**

The study has sourced secondary data from various organisations like Directorate of Economics and Statistics, National Sample Survey Office (NSSO), and, Ministry of Agriculture and Farmers Welfare for the

period 2006-07 to 2013-14 keeping in view the same interval required for DFI by 2022. Conventional tools and techniques like simple averages, ratio and graphical analysis were done for arriving valid conclusions.

**Trends and Dynamics in Wheat Producers Income and Yield**

Deciphering the trends across states and over time provides the dynamism behaviour of income from wheat production in different regions (Figure 1) which facilitates for drawing economic implications and set geographical priorities. Here, we accounted for the main-product (grain) as well the by-product (straw) from wheat production. The gross income between 2006-07 and 2013-14 has doubled in a majority of the states like Bihar, Gujarat, Jharkhand, Madhya Pradesh and West Bengal (Table 1). The source of income comes from productivity (grain+straw) and its value that is, price x total output. On an average, the country as a whole is close to income doubling with an estimated ratio of 1.94. The rising price is one of the major reasons for the increased income apart from the productivity escalation. Agriculture being biological in nature with geographical concentration, wheat productivity across India exhibited spatial and temporal variations. The yield ratio across states as shown in Figure 2 were more than one barring Chhattisgarh (0.99) and Himachal Pradesh (0.78) though not doubled in the rest. The income ratio was highest in the case of Jharkhand (1.88). Productivity across states alarmed that only a few



Data: Directorate of Economics and Statistics, Government of India

Figure 1: Spatial and temporal trends in the gross income (₹/ha) from wheat production

**Table 1: Ratio and growth rate of income and yield (2006-07 to 2013-14)**

States	Income		Yield	
	Ratio	CAGR (per cent)	Ratio	CAGR (per cent)
Bihar	2.34	11.90	1.34	3.10
Chhattisgarh	1.43	7.30	0.99	2.23
Gujarat	2.21	11.03	1.17	0.72
Haryana	1.97	9.61	1.14	1.51
Himachal Pradesh	1.25	3.50	0.78	-2.51
Jharkhand	3.08	20.47	1.88	12.67
Madhya Pradesh	2.02	11.86	1.31	5.79
Punjab	1.93	9.19	1.19	2.25
Rajasthan	1.91	10.23	1.12	2.85
Uttar Pradesh	1.75	7.89	1.08	1.23
Uttarakhand	1.76	6.16	1.01	-0.32
West Bengal	2.15	10.52	1.46	5.52
<b>India</b>	<b>1.94</b>	<b>9.67</b>	<b>1.18</b>	<b>2.55</b>

*CAGR: Compound annual growth rate*

states like Punjab, Haryana and Rajasthan have registered more than the national average corroborating the findings of Sendhil *et al.*, 2012 (Figure 2). The divergence was more in Jharkhand, Himachal Pradesh and Chhattisgarh. The change in yield from 2006-07 to 2013-14 was highest in the case of Jharkhand (+1048 Kg/ha), followed by West Bengal (+995 Kg/ha) and Punjab (+813 Kg/ha).

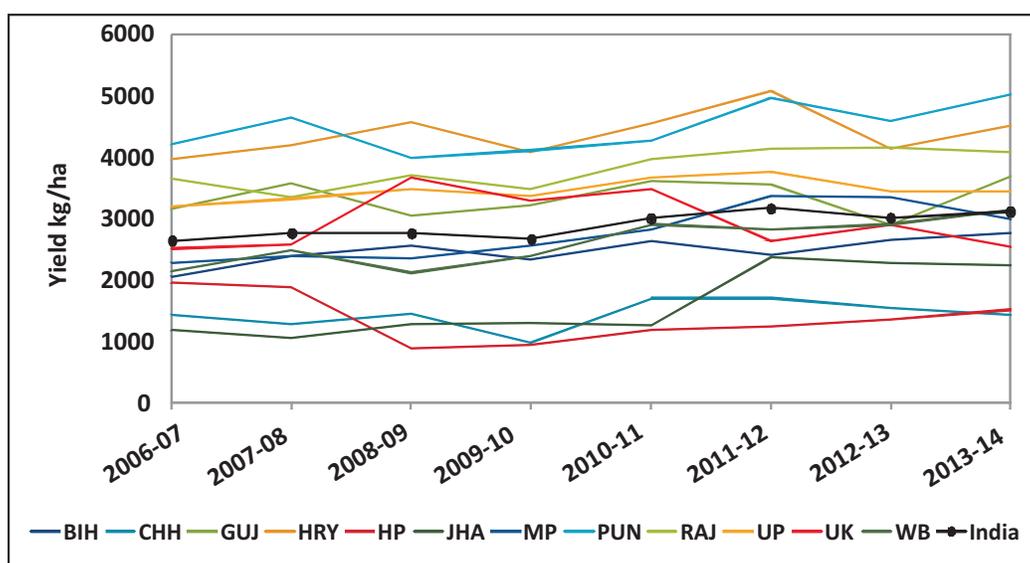
Perusal of Table 1 clearly indicates that states that attained doubling in income has witnessed a sharp increase in their yield levels during 2006-07 to 2013-14. Hence, productivity enhancement or bridging yield gaps

in the secondary and tertiary high yielding states and cost reduction for primary high yielding states should be the strategy for DFI.

**Pathway and Potential Drivers for DFI by 2022**

The aim of the government to double the income of farmers in a span of six years since DFI announcement (2016) requires a compound growth rate of 12.25 per cent per annum. This growth rate shall be achieved only through convergence and synergy in the drivers for DFI. The drivers for the potential pathway have been discussed under three major categories: science & technology, institutions and policies that help to transform wheat production (Figure 3). Increasing the productivity, remunerative output prices, focus on land use in terms of diversification and ownership, risk management, and geographical focus (NITI Aayog, 2015); high output growth and favourable output prices (Chand *et al.*, 2015); access to information for increasing the productivity (Birthal *et al.*, 2015); focus on eastern region and raising livestock (Chandrasekhar and Mehrotra, 2016); establishment of special agricultural zones (ICFA, 2016) and enhancing the resource use efficiency, and risk management (Sen, 2016) are some of the potential options suggested for increasing the farmers' income. The dimensions for pushing the production frontier are optimal use of inputs and resource services, modern technologies resulting in enhanced output and shift to intensive conservation agricultural practices resulting in increased total factor productivity (Sendhil *et al.*, 2015). The sources of growth should include bridging of existing yield gaps across the wheat growing regions despite the concerted efforts to increase the crop productivity (Sendhil *et al.*, 2014).

**Science and Technology:** Application of science by



Data: Directorate of Economics and Statistics, Government of India.

**Figure 2: Productivity trend for major wheat producing states**

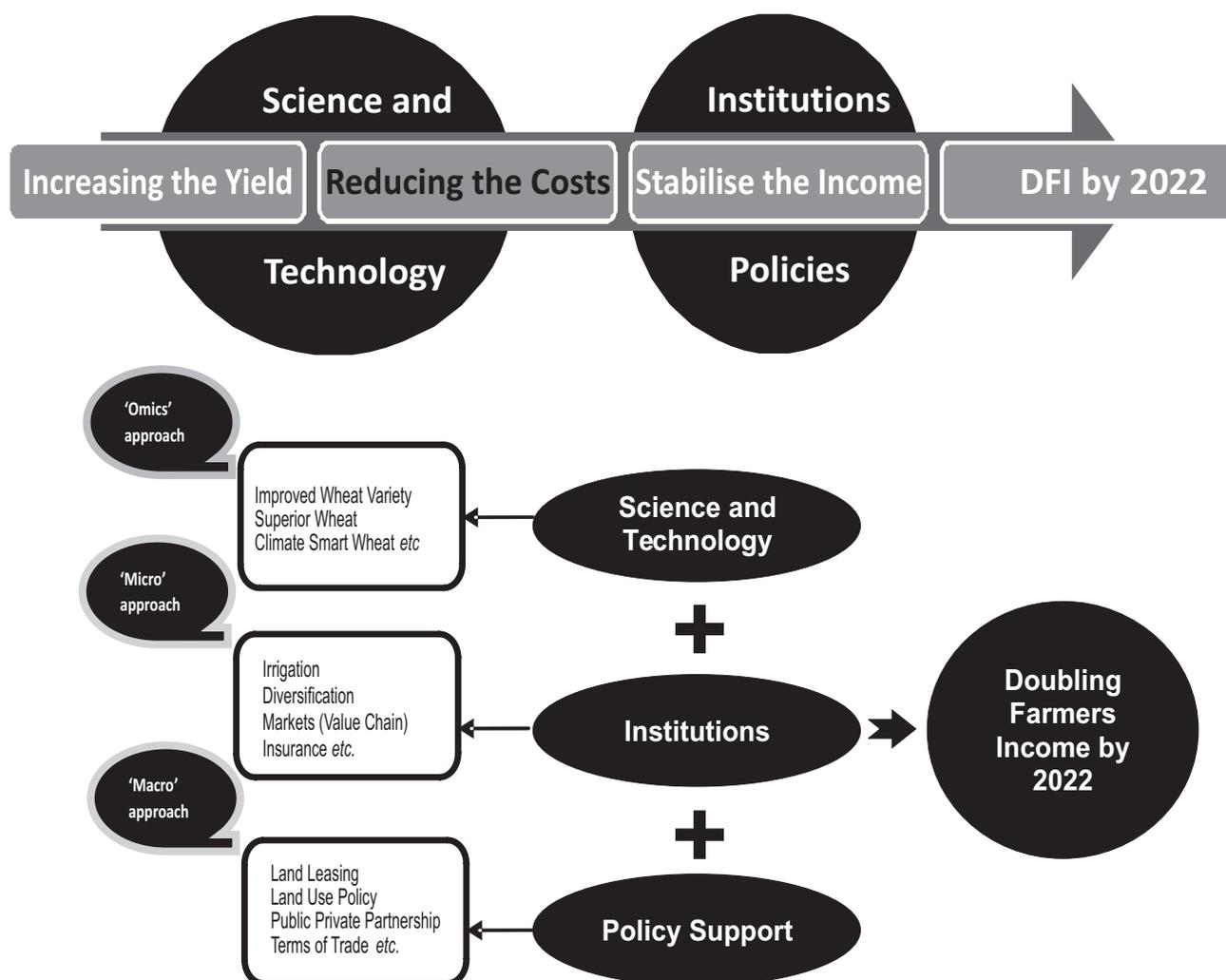


Figure 3: Framework for doubling the wheat producers' income by 2022

researchers results in technology that is, cost reduction and/or yield enhancement. The technology (an improved wheat variety) derived from the wheat improvement programme as depicted in Figure 4 pushes the production frontier upward (Singh *et al.*, 2016) by increasing yield trends over a period of time (additional average gross income of INR 10685/ha shall be obtained as evident from the demonstrations conducted across India).

On the other hand, validated scientific techniques like conservation agriculture practices facilitate for increased income by reducing the cost of resource use (Zero Tillage: reduction in operational costs by ₹3400/ha apart from yield enhancement and restricting resource damage at farmers field). Strictly, science and technology help to increase the output with the same level of resource use and resource services or producing the same quantum of output with reduction in the input usage. Alternatively, technical efficiency will be increased through better technologies and techniques. Further, the output level can be enhanced by consolidating the existing level of technology by bridging the yield gaps substantially as

demonstrated by the agronomic potentials and management interventions achieved in research and extension farms and the actual yields obtained in average farmer's fields.

The productivity level has to be increased across the wheat growing villages/blocks/districts/states/zones through improved varieties, an outcome of research coupled with mass adoption of resource conservation technologies like zero tillage. For instance, with respect to wheat growing states, the focus should be on regions like Madhya Pradesh comprising 12.63 per cent of total wheat households and Uttar Pradesh comprising 42.45 per cent of total wheat households with high yield gaps i.e., having more scope to augment the yield with the necessary condition of having more wheat growers in that region in the context of DFI.

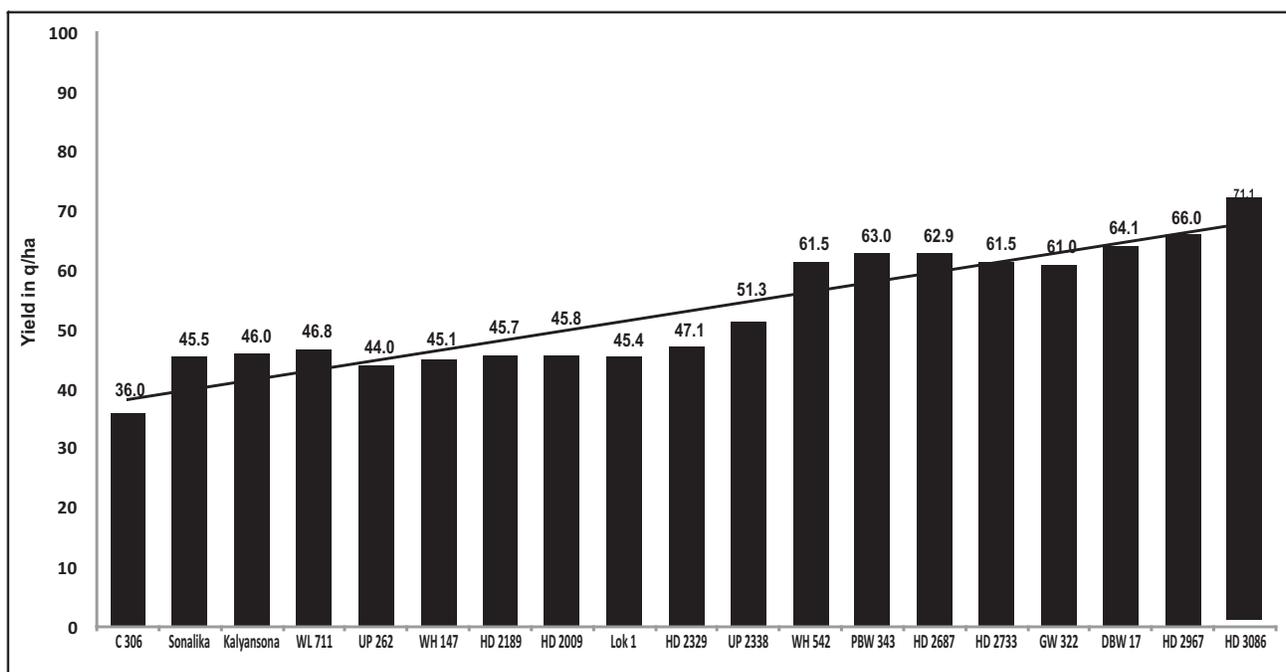
Yield levels in a majority of the states have struck a plateau demanding for intervention through cutting-edge and high throughput genomics approach for breaking the genetic potential. For instance, development of wheat hybrids certainly would raise the farm productivity.

**Table 2: Yield gap vis-à-vis yield matrix (TE 2015-16)**

Parameter	Low yield gap	High yield gap
Low yielding states*	Bihar, Himachal Pradesh, Maharashtra and West Bengal	Assam, Chhattisgarh, Jammu & Kashmir, Jharkhand, Karnataka, Madhya Pradesh, Tamil
High yielding states*	Delhi, Haryana, Punjab and Rajasthan	Uttar Pradesh

*Yield Gap: Difference between national average and state average*

*\* indicates that the triennium ending national average has been taken as slab*



**Figure 4: Trend in potential yield of popular wheat varieties**

Science should facilitate development of high yielding but short duration genotypes reducing the stress on land and rejuvenation of soil. The concern here is to increase the productivity per day rather than yield per unit area. Developing climate smart wheat varieties will tackle the yield sensitivity on account of climate change (Sendhil *et al.*, 2016). However, the limitation here is that the window period for technology development and its adoption is too less in the context of DFI by 2022. Alternatively, the below suggested package of practices will enhance the wheat producers' income by INR 10685 per ha as evident through FLDs:

- Seed replacement and varietal replacement of improved wheat varieties
- Soil test based fertilizer application
- Use of more bio-fertilizers, vermicompost and FYM in addition to chemical fertilizers
- Supplementing soil with micro nutrients like Mn, S, Zn and Fe (if deficient)
- Sowing the seeds after treatment for better germination and healthy seedlings
- Undertaking normal sowing (date of sowing) to

take advantage of the weather anomalies

- Adopting the recommended package of practices (region specific)
- Involving women in inter-cultural operations like weeding to reduce the cultivation costs
- Capacity building and skilling on special practices that improves the economic efficiency

Harnessing the technology for increasing the efficiency should be viewed in a holistic perspective. Technologies that promote better resource use efficiency always result in lower costs of production and higher net income. It has to be utilised through collective/community approach, right from resource planning and production to value addition and marketing for raising the income. Most of the rural areas face severe input crisis like water and quality seeds which directly have an adverse impact on production. Mass adoption of resource conservation techniques like zero tillage, micro irrigation and seed priming will counter the water stress. Soil test based fertilizer application will avoid the irrational use of resources. Since the cost of farming keeps on surging, replacing the use of costly inputs with cheap inputs

without damaging the environment is a viable option. It is well established that a substantial amount of wheat loss occurs in transport and storage which reduces the physical availability and in turn affects the farmer's income. Reducing the pre and post-harvest losses through scientific storage structures like 'silos', processing and value addition both at farm and community level supplements the production in tune with the aphorism, 'a grain saved is a grain produced'.

**Institutions:** As agriculture in India is a gamble with the monsoon, the adventure and the enterprise is worth pursuing only under adequate risk management availability. Weather anomaly is one of major reasons that results in crop failure. Terminal heat stress, drought and hailstorms are frequently encountered by wheat producers in a majority of the regions and hence it has to be managed through risk aversion mechanisms. The risk coverage in vogue till recently through the National Agricultural Insurance or Modified National Agricultural Insurance through Weather based Crop Insurance has been based on cost of cultivation and crop loan (credit) than income insurance. The game changer is the new science and technology based (involving use of satellite imageries, drones, automatic weather stations, GPS, mobile phone, bank account and social security 'aadhar' number) crop insurance scheme, Prime Minister's Crop Insurance Scheme, which is based on crop income than cost of cultivation/credit. The new crop insurance policy unfolded covers all the cultivators and not merely the ones availing crop loans, at 50 per cent of the premium and the rest shared between the state and central governments and covers the sum assured or income by covering the loss in sowing, loss of crop and loss in harvest. The schemes envisage the use of technology - satellite imagery, GPS, mobile phone in assessing the damage scientifically eliminating human bias and impending compensation through payment into the bank account of the cultivator. Irrigation is the best insurance against drought and it enhances the productivity in general. It has been proved so effective in increasing the output growth particularly during the green revolution era (Sendhil *et al.*, 2012). The thrust of the government is to ensure 'Per drop more crop' by accelerated irrigation schemes supplemented by massive promotion of micro irrigation techniques like drip and sprinkler to enhance the water use efficiency. Enhancing irrigation potential and intensity is a viable and potential option. Wheat should get transformed as a high value crop by tapping the global market demand for wheat based products. Bringing more area under mechanisation is another option in areas where labour scarcity prevails which result in scale economics. Utilisation of electronic gadget, and, information and communication technology for better market connectivity and price realization is well established (Birthal *et al.*, 2015) and is the need for a majority. The recently initiated e-National Agricultural Marketing (e-NAM) brings more than 500 markets on a single e-

platform integrating markets sans middle men and enabling farmers to bid their products to sell any where in India. Further, woman/self-help groups shall be trained and involved in making wheat based products for improving the income at the household level.

Financial viability is a major driver for sustaining wheat production for which farmers have to get the right price for their produce (Reganold *et al.*, 2011). Segregated procurement for wheat based on the grades like premium/good/fair quality wheat will fetch more income for better quality. Staggered support price will encourage the practice of storage at farmer' level but the selling price of the producer at a later date should be more than the storage cost. In regions, where government is not involved in procurement or not providing better market opportunities, tripartite contract farming (Farmer-Government-Contract Company) can be done under the regulation of the government. Better price realisation through competitive markets, establishment of agribusiness hubs or zones, value chains and improved market linkage will augment the farm income (ICFA, 2016). Integrated farming system, mixed farming and diversification should be a part in the entire farm household (ICFA, 2016). The suggested farm activities should be market-oriented for boosting the income. For instance dairying shall be viewed as a supplementary enterprise wherein wheat straw can be used as a feed for the cattle.

**Policy:** The average size of operational holdings in India is 1.15 ha and around 85 per cent fall under the marginal and small land holders as per the Agricultural Census (2010-11). Since a majority fall under limited holding size, collective or joint farming will reduce the costs significantly owing the operation of economies of scale. Irrespective of sectoral differences, the centralized monolithic research structure has to branch out for several decentralized and location specific research (Raina, 2016) as well as action plans. Public and private partnership should be the priority for increasing the farm productivity as well as efficiency which warrants for high level of investment to unleash the research potential for sustainable development (Rankin *et al.*, 2016; USAID, 2015; Chadha *et al.*, 2013; Fuglie & Schimmelpfennig, 2010; Ludena *et al.*, 2007; Fan *et al.*, 1999). Government should proactively address the resource crisis situation. For instance, building farm ponds (short-run) in less rainfall areas and promoting micro irrigation techniques like sprinkler and drip (long-run) where groundwater utilisation is abysmal. Linking rural roads to crucial inputs (seed and fertilizer cooperatives) market is another viable option to reduce the drudgery in transport.

Gaining the benefits of germplasm sharing is still a problem for India on account of strict IPR regime under the TRIPS agreement which has to be rationalised for harnessing the genetic potential of exotics (Jacob *et al.*, 2015). The law on conservation and sharing of superior germplasm should be enforced on the trust between the

'provider' and 'user' and providing a mechanism for fair and equitable sharing of benefits. Risk management (price as well as production) through relevant insurance products will off-set the loss if happens in any uncertain situation and it should be made compulsory at all levels across regions. Prime Minister's Crop Insurance scheme (The Pradhan Mantri Fasal Bima Yojana) is a first of its kind that covers the risk of any post-harvest loss. Alternatively, farmers' income shall be enhanced by regulating the farm product prices relative to their non-agricultural counterparts as done during 2004-05 and 2011-12. The terms of trade helped to increase the agricultural output by 34 per cent at constant prices (2.65 times in nominal terms) and real farm income by 63 per cent. However, the period for increased income depends on the terms of trade and inflation magnitude (Chand, 2016).

Agriculture Census (2010-11) reports that 47 per cent of the farm households operate on plots less than an acre which is highly fragmented and about half of it has no access to irrigation. An assessment by the National Sample Survey Office (NSSO) indicated that many would like to quit farming and many would like to increase size by pooling. But land leasing is insecure, informal and inefficient as on date. Absentee landlordism is more due to fear over loss of ownership. The state should enable ease out without ceding away ownership and facilitate consolidate holdings for economic operation through land leasing laws coupled with direct transfer of benefits to the cultivator than the owner of the land. Legalized leasing will enable cultivators' access to credit, subsidies, insurance and other entitlements that will facilitate land improvement and investment (Expert Committee, 2016). In the past, income growth was driven largely by price variable. Hence support price has to be increased keeping in view of cost escalation every year to sustain the growth momentum.

## CONCLUSIONS

Farm income is the most relevant measure to assess the farmers' welfare and agriculture transformation. Certainly, income from cultivation alone will not help to achieve the set target of DFI but it has to be supplemented with other farm and non-farm activities. If technology and factor prices could result in per-unit cost savings, farmers' income would rise at a much higher rate than the rate of increase in output. Even today, the returns on investment on per unit basis are higher from agriculture with associated risk and uncertainties but lack in scale economics unlike corporate investment. The potential pathway is enhancing the productivity by harnessing the genetic gains coupled with reduction in costs by appropriate technologies. The realised income should be stabilised over a period of time for being on the track of DFI. Certainly, the ambition can be fulfilled by warranting the required attention and leadership that science & technology, institutions and policy deserves to pay the fruitful dividend.

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## **How to Double Farmers' Income by 2022? : A Sector-Wise Growth Rate and Decomposition Analysis**

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### **ABSTRACT**

*This paper studies the past performance of the agriculture sector so as to understand how farmers' income can be doubled by 2022. The time series data at all India level on area, production and productivity of foodgrains, production and per capita availability of milk and eggs and production of meat were compiled and a decade wise analysis of growth rate and decomposition analysis was done. During the overall period, the area under food grains showed negative growth whereas production and productivity growth was positive. Production of milk, egg and meat showed positive growth. Growth rate in area, production and productivity of both vegetables and fruits was positive. For foodgrains, the yield effect was higher than the area effect which could be attributed to increased use of high yielding varieties. For vegetables and fruits, the contribution of area effect was more than that of yield and the interaction effect suggesting that measures should be taken to improve their productivity.*

### **Keywords**

Decomposition, foodgrains, fruits, growth rate, meat, milk, vegetables

### **JEL Codes**

D24, O12, O47, Q18

### **INTRODUCTION**

Farmers earn income from various sources such as foodgrains, horticulture, dairy and other allied activities. Increase in yield or productivity of crops and other enterprises is the single most important factor that can increase income (NABARD, 2016). Indian agriculture has undergone tremendous transformation over the years from a state of severe food crisis to self sufficiency in food grain production. The foodgrains production increased from 50 Mt in 1950-51 to a record production of 264.8Mt in 2013-14 (Anonymous, 2014-15). The sector has also diversified towards high-value commodities such as fruits and vegetables, milk, eggs, poultry, and fish, in response to changing demand patterns fuelled by a growing economy and rising income levels. India's diverse climate ensures availability of all varieties of fresh fruits & vegetables. It ranks second in fruits and vegetables production in the world, after China. During 2013-14, India produced 88.98 million metric tonnes of fruits and 162.90 million metric tonnes of vegetables (Indian Horticulture Database, 2014). It is the largest producer of milk with a production of 146.31 Mt during 2014-15.

Despite such a rosy picture of the agriculture sector, India still has a long way to go in terms of achieving the goal of doubling farmers' income by 2022, i.e., in the next five years as has been articulated in the union budget for 2016-17. This paper endeavours to analyze the changes, trends and growth in area, production and productivity of foodgrains, vegetables and fruits, production and per capita availability of milk and eggs and production of meat through compound growth rate analysis for the last few decades. Decomposition analysis has also been performed to reveal the different magnitude of contribution of the growth of output by area, yield and interaction as done by authors such as Bastine and Palanisami (1994) and Mundinamani *et al.* (1995).

### **METHODOLOGY**

The secondary data at all India level on area, production and productivity of foodgrains, vegetables and fruits, production and per capita availability of milk and eggs and production of meat were compiled from various issues of Basic Animal Husbandry Statistics, published by Department of Animal Husbandry and Dairying, Ministry of Agriculture, Government of India.

The data were collected and compiled for 30 years, i.e., 1985-86 to 2014-15 and were further divided into three decades- Decade I from 1985-86 to 1994-95, Decade II from 1995-96 to 2004-05 and Decade III from 2005-06 to 2014-15. In case of vegetables and fruits, due to insufficient availability of data, data were collected and compiled for a period of twenty years and divided into two decades, i.e., Decade I from 1995-96 to 2004-05 and Decade II from 2005-06 to 2014-15. The methods used in the study were estimation of growth rate with its test of significance and decomposition of growth components.

To estimate the compound growth rate following formula was used:

$$\text{Log } Y = a + \beta t$$

$$\text{Growth rate} = (\exp(\beta) - 1) * 100$$

In order to measure the percentage contribution of area, productivity and their interaction towards the production of foodgrains, vegetables and fruits the technique of decomposition has been adopted as used by several researchers (Bastine and Palanisami, 1994; Bhatnagar & Nandal, 1994; Mundinamani *et al.*, 1995; Kalamkar *et al.*, 2002; Roy *et al.*, 2015). The change in the production of Vegetables between any time periods can be expressed as

Change in production = Productivity effect + Area effect + Interaction effect

$$\Delta P = A_0 \Delta Y + Y_0 \Delta A + \Delta A \Delta Y$$

$$\text{Where, } \Delta P = P_n - P_0, \Delta Y = Y_n - Y_0, \Delta A = A_n - A_0$$

$A_0$ ,  $P_0$  and  $Y_0$  are area, production and productivity in base year and  $A_n$ ,  $P_n$  and  $Y_n$ , are area, production and productivity in current year  $\Delta A$  and  $\Delta Y$  represent change in area and productivity, respectively.

## RESULTS AND DISCUSSION

### Growth Rates of Area, Production and Productivity

To estimate the growth performance of agriculture at the national level, time series data on area, production and productivity of food grains for the period 1985-86 to 2014-15, and of vegetables and fruits for the period 1995-96 to 2014-15, were analysed. To understand the decadal performance, the whole period was divided into three decades, viz. 1985-86 to 1994-95 (I decade), 1995-96 to

2004-05 (II decade), 2005-06 to 2014-15 (III decade) and overall period 1985-86 to 2014-15, in case of food grains. In case of vegetables and fruits, the whole period was divided into two decades, viz. 1995-96 to 2004-05 (I decade), 2005-06 to 2014-15 (II decade) and overall period 1995-96 to 2014-15. The growth performance of high value commodities such as milk, egg and meat were estimated by analyzing production of milk, egg and meat and per capita availability of milk and egg for the period 1985-86 to 2014-15.

### Foodgrains, Milk, Egg, Meat

#### First Decade (1985-86 to 1994-95)

During this period the growth in area of food grains is negative, while the growth in production and productivity were positively significant. In case of milk and egg there is positive growth rate in both production and per capita availability. In the production of meat positively significant growth rate was observed (Table 1).

#### Second Decade (1995-96 to 2004-05)

During this period the same trend was observed in growth in area of food grains as in the first decade where it was negative while production and productivity registered positive growth rate. With regard to milk and egg there was positive growth in both production and per capita availability where per capita availability of egg was positively significant. With respect to meat production there was negative growth rate during this period.

#### Third Decade (2005-06 to 2014-15)

This period witnessed positive growth rate in the area of food grains with production and productivity showing significant positive growth rate. As for milk and egg both production and per capita availability showed positive growth rate. Positively significant growth rate was observed in meat production during this period.

#### Overall Period (1985-86 to 2014-15)

During the total period, the area under food grains showed negative growth rate whereas production and productivity growth was positive. As for milk and egg both production and per capita availability showed positive growth rate. Meat production showed a positively significant growth rate during this period.

**Table 1: Compound growth rate of area, production and productivity of foodgrains, Production and per capita availability of milk and eggs and meat production**

Particular	Factor	1985-86 to 1994-95	1995-96 to 2004-05	2005-06 to 2014-15	1985-86 to 2014-15
Foodgrains	Area	-0.325	-0.346	0.070	-0.075
	Production	3.176***	0.554	2.484***	1.826
	Productivity	3.508***	0.904	2.409***	1.901
Milk	Production	4.214	3.685	4.467	4.183
	Per capita availability	2.075	1.930	3.079	2.384
Egg	Production	5.206	6.183	5.769	5.633
	Per capita availability	3.196	4.472***	4.184	3.774
Meat	Production	17.539***	-2.209	12.438***	3.045***

\*, \*\* and \*\*\* denote significance at 10 per cent, 5 per cent and 1 per cent levels, respectively

**Vegetables and Fruits****First Decade (1995-96 to 2004-05)**

There was positively significant growth rate in area, production and productivity of vegetables. As for fruits, area and production showed positively significant growth rate whereas productivity registered negative growth.

**Second Decade (2005-06 to 2014-15)**

During this decade, vegetables showed positive growth in area and production and positively significant growth in productivity. With regard to fruits there was positive growth in area, production and productivity and the growth in area was positively significant.

**Total Period (1995-96 to 2014-15)**

There was positive growth rate in area, production and productivity of both vegetables and fruits during this period (Table 2).

**Contribution of Area, Productivity and their Interaction**

With the help of additive decomposition model the percentage contribution of area, productivity and their interaction on production of foodgrains, vegetables and fruits has been analysed and presented in Tables 3 and 4.

A perusal of Table 3 reveals the effect of area, yield and their interaction to the production of foodgrains during the three decades 1985-86 to 1994-95, 1995-96 to 2004-05 and 2005-06 to 2014-15 and also the overall period of 1985-86 to 2014-15. In the first decade (1985-86 to 1994-95), the contribution of yield to foodgrains production was found to be higher and even offsetting the

area effect and interaction effect. Similar result was obtained for the second decade. In the third decade, the area effect was positive but its percentage contribution (1.58 per cent) was much lower than the yield effect (98.10 per cent). For the overall period, the contribution of yield effect offset that of area and interaction effects. So, in general we observed that the yield effect was higher than the area effect which can be attributed to the increased use of high yield varieties and fertilizers. Similar results were obtained by Kalamkar *et al.* (2002).

In case of vegetables, as seen from Table 4, in the first decade, the area effect played a major role contributing 69.55 per cent to total production followed by yield effect (24.04 per cent) and interaction effect (6.40 per cent). Similar result was obtained for the second period where area effect contributed 67.47 per cent followed by yield and interaction effects contributing 24.02 and 8.41 per cent respectively. For the overall period also a similar pattern was seen as area effect contributed 58.26 per cent, followed by yield (23.34 per cent) and interaction effect (18.40 per cent). As for fruits, in the first decade, among the three effects, the area effect was found to contribute more (76.50 per cent) followed by yield effect (15.89 per cent) and interaction effect (7.61 per cent). In the second phase, a different picture can be seen where the contribution of yield effect is higher (58.07 per cent) followed by area effect (35.61 per cent) and interaction effect (6.32 per cent). For the overall period from 1995-96 to 2014-15 also, similar to the first decade, the area effect

**Table 2: Compound growth rate of area, production and productivity of Vegetables and Fruits**

Particulars	Factor	1995-96 to 2004-05	2005-06 to 2014-15	1985-86 to 2014-15
Vegetable	Area	2.245***	3.354	3.270
	Production	3.3823***	5.119	4.842
	Productivity	1.113*	1.723***	1.521
Fruit	Area	3.541***	2.455***	4.321
	Production	1.518***	4.913	4.611
	Productivity	-1.986	2.377	0.270

\*, \*\* and \*\*\* denote significance at 10 per cent, 5 per cent and 1 per cent levels, respectively

**Table 3: Contribution of area, productivity (yield) and their interaction to food security in the production of Foodgrains in India during the three decades 1985-86 to 1994-95, 1995-96 to 2004-05 and 2005-06 to 2014-15 and overall period 1985-86 to 2014-15**

Particular	Variable	1985-86 to 1994-95	1995-96 to 2004-05	2005-06 to 2014-15	1985-86 to 2014-15
Foodgrains	$\Delta P$	44.41 (100)	17.94 (100)	43.42 (100)	101.58 (100)
	$A_0 \Delta Y$	47.49 (106.95)	19.48 (108.56)	42.59 (98.10)	114.02 (112.25)
	$Y_0 \Delta A$	-1.54 (-3.48)	-1.39 (-7.73)	0.69 (1.58)	-7.07 (-6.97)
	$\Delta A \Delta Y$	-1.54 (-3.48)	-0.15 (-0.83)	0.14 (0.32)	-5.36 (-5.28)

The values within the parentheses are percentage share of column total ( $P$ = Production in million tonnes,  $A$ = Area in million ha,  $Y$ = Yield in tonnes/ha,  $\Delta P$ ,  $\Delta A$  and  $\Delta Y$  are change in production, area and yield, respectively.)

**Table 4: Contribution of area, productivity (yield) and their interaction to food security in the production of Vegetables and Fruits in India during the two decades 1995-96 to 2004-05 and 2005-06 to 2014-15 and overall period 1995-96 to 2014-15**

Particulars	Variable	1995-96 to 2004-05	2005-06 to 2014-15	1995-96 to 2014-15
Vegetables	$\Delta P$	27366.48 (100)	57688.33 (100)	96771.79 (100)
	$A_0\Delta Y$	6579.83 (24.04)	13859.49 (24.02)	22584.83 (23.34)
	$Y_0\Delta A$	19034.70 (69.55)	38922.00 (67.47)	56376.48 (58.26)
	$\Delta A \Delta Y$	1751.95 (6.40)	4906.83 (8.51)	17810.48 (18.40)
Fruits	$\Delta P$	26049.07 (100)	18029.00 (100)	60002.87 (100)
	$A_0\Delta Y$	4140.30 (15.89)	10469.00 (58.07)	14211.30 (23.68)
	$Y_0\Delta A$	19926.80 (76.50)	6420.00 (35.61)	34137.20 (56.89)
	$\Delta A \Delta Y$	1981.97 (7.61)	1140.00 (6.32)	11654.37 (19.42)

*The values within the parentheses are percentage share of column total (P= Production in '000 tonnes, A= Area in '000 ha, Y= Yield in tonnes/ha,  $\Delta P$ ,  $\Delta A$  and  $\Delta Y$  are change in production, area and yield, respectively.)*

contributed a major part (56.83 per cent).

So, in general, for vegetables and fruits we see that the contribution of area effect is more than that of yield and the interaction effect. This suggest that measures should be taken to improve their productivity such as varietal improvement and appropriate technologies, as increasing the acreage under them can pose difficulties due to limited availability.

#### CONCLUSION AND POLICY IMPLICATIONS

The growth rate of area under food grains showed negative growth rate whereas production and productivity growth was positive during the overall period from 1985-86 to 2014-15. For milk and egg, both production and per capita availability showed positive growth. Meat production showed a positively significant growth rate. There was positive growth rate in area, production and

productivity of both vegetables and fruits. In terms of contribution of yield, area and interaction effects to growth of output, for foodgrains, the contribution of yield effect offset that of area and interaction effects which can be attributed to the increased use of high yielding varieties and fertilizers. In general, for vegetables and fruits we see that the contribution of area effect is more than that of yield and the interaction effect. Since the area cannot expand much, either through increase in net sown area or through increase in cropping intensity, enhancing the productivity is the only route available to enhance production and help in achieving the goal of increasing farmers' income by 2022. While varietal improvement through conventional breeding or biotechnology is a long term option, bridging yield gaps through adoption of recommended agronomic practices, planning profitable crop mix that can maximize aggregate income, and reducing crop losses through integrated pest management are short/medium term options that can bring in additional income. Agricultural extension services aimed at offering information and improved inputs, including seed and cultivars for better crop diversity, small livestock and poultry ventures, marine fisheries and aquaculture will be helpful.

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## **Inter-District Disparities in the Socio-Economic Development of Himachal Pradesh**

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### **ABSTRACT**

The economy of Himachal Pradesh is dependent upon the Agriculture & Horticulture and any fluctuation in the production impacts the economy at large. Districts of Himachal Pradesh have been ranked on the basis of their levels of development obtained with the help of optimum combination of 35 indicators related to agriculture, social and industrial sectors. The district wise data in respect of the indicators published by Himachal Pradesh government for the year 2014-15 were used for all 12 districts in Himachal Pradesh for the present study. Techniques adopted by Narain et al. (1991, 1995) have been used in addition to principle component analysis and factor analysis for ranking the districts. The districts Kangra, Mandi, Sirmaur and Shimla were found to be most developed whereas the districts Lahaul and Spiti, Kinnaur, Bilaspur and Hamirpur were found to be low developed districts in the overall development.

### **Keywords**

Composite index, developmental indicators, socio-economic development

### **JEL Codes**

C81, O11, O12, Z13

### **INTRODUCTION**

Socio-economic development of the country has always remained a cherished goal before the planners since launching of the First Five-Year Plan. Hill areas in India constitute 21 per cent of total geographical area and nine percent of total population of the country. The hill areas hold basic life support system and natural resources. A large part of population in the plains is dependent on hill resources especially of Himalayan region. Most of the perennial rivers in the country originate and have their watershed in the Himalayas. Out of 13 hill states and regions, Himachal Pradesh is observed to be the most progressive state, which has made remarkable achievements in socio-economic development of its people. The state is being viewed as a model for development of Hindukush Himalayan region. The state has created a new concept in the development of the hill economy through transformation brought about in agriculture, horticulture and animal husbandry (Verma & Pratap, 1992). Himachal Pradesh is located in the northern part of the country. It has an international border with Tibet in the east, Indian states of Jammu and Kashmir

in the north, Punjab in the west and southwest and Haryana and Uttar Pradesh in the south. The state forms part of western Himalayan Zone. It has a hilly terrain, mountainous and undulating topography with altitude ranging from 350 to 6,975 meters above mean sea level. The economy of Himachal Pradesh started its development journey from scratch; today the State has not only emerged as a model of development of hill areas in the country, but has also emerged as a pioneer in various fields of development.

Agriculture contributes over 45% to the net state domestic product. It is the main source of income and employment in Himachal. Over 93% of the population in Himachal depends directly upon agriculture, which provides direct employment to 71% of its people. The main cereals grown are wheat, maize, rice and barley. Apple is the principal cash crop of the state grown principally in the districts of Shimla, Kinnaur, Kullu, Mandi, Chamba and some parts of Sirmaur and Lahaul-Spiti with an average annual production of 5 lakh tonnes and per hectare production of 8 to 10 tonnes. The apple cultivation constitute 49 per cent of the total area under

fruit crops and 85% of total fruit production in the state with an estimated economy of ₹3500 crore. Apples from Himachal are exported to other Indian states and even other countries. In 2011-12, the total area under apple cultivation was 1.04 lakh hectares, increased from 90,347 hectares in 2000-01.

Socio-economic development is to improve the quality of life of people by creation of appropriate infrastructure, among others, for industry, agriculture environment. Economic planning of the country is aimed at bringing about maximum regional development and reduction in regional disparities in the pace of development. Programmes of development have been taken up in the country in a planned way through various Five Year Plans. Tanwar *et al.* (2016) made a study of western districts of Uttar Pradesh and have undertaken several policy measures to enhance the levels of the development in agriculture, social and industrial sectors using secondary data on a number of indicators published by Uttar Pradesh government for the year 2011-12. The principal component analysis, factor analysis have been used. The ranking of the districts in respect of performance in agriculture, Social and Industry have been obtained in this study. The Composite Indices (C.I.) of development in respect of 18 developmental indicators in which 6 indicators were directly concerned with agricultural development and the rest of 12 indicators describe the availability of social and industrial facilities for 26 districts of western Uttar Pradesh. The Green Revolution in the agriculture sector and commendable progress on the industrial front has certainly increased the overall total production, but there is no indication that these achievements have been able to reduce substantially the regional inequalities in the level of development (Narain *et al.*, 2007). Although resource transfers are being executed in backward region of country, it has been observed that the regional disparities exist in terms of socio-economic development are not declining over time (Narain *et al.*, 2003). Inter and intra-section differences in the economic structure have become more sharp and noticeable. Consequently, certain areas went ahead leaving other lagged behind (Siddiqui, 2012).

Tiwari (2008) brings out an assessment of the progress of economic infrastructure and agricultural development in Himachal Pradesh during 1981-2001. In this paper, two major components of development, viz. the agriculture and economic infrastructure have been analysed at district level in the State using principal component analysis based on 23 indicators. The study reveals that a positive significant correlation between economic infrastructure and agricultural development in all the districts of Himachal Pradesh in the study period. The notion of development in the context of regional development refers to a value positive concept which aims to enhance the levels of living of the people and general conditions of human welfare in a region. Socio-economic developments have become one of the most important

glaring and growing problems not only in developing countries but also in the most advanced countries of the World (Tanwar *et al.*, 2016a).

The present study is conducted in Himachal Pradesh at district level, where the data on socio-economic variables for the year 2014-15 were analyzed for estimating the level of development. The level of development is estimated separately for agricultural sector, infrastructural facilities and overall socio-economic field. It will be of interest to estimate the level of development at district level since there has been a growing consensus about the need of district level planning in the country. Knowledge of level of development at district level will help in identifying where a given district stands in relation to others.

#### METHODOLOGY

This study seeks to determine district-wise levels socio-economic and agricultural development. For this purpose three sets of indicators have been identified comprising 23 indicators from agriculture sector to examine agricultural development and 12 indicators from socio-economic sector to examine socio-economic development. The district wise data in respect of the indicators published by Himachal Pradesh government were used for all 12 districts in Himachal Pradesh (Appendix 1) for the year 2014-15.

**Developmental Indicators:** The composite indices of development for different districts were obtained by using the data on the following development indicators:

1. Average size of operational holding (hectare)
2. Percentage of net area irrigated to net area sown
3. Percentage of area sown more than once to net area sown
4. Percentage of area under commercial crops to total cropped area
5. Yield in kg/hectare of wheat
6. Yield in kg/ha of maize
7. Yield in kg/ha of rice
8. Yield in kg/ha of pulses
9. Production of food grains ('000 tones)
10. Fertilizer consumption terms of nutrients (tones)
11. Total area covered under apple (ha)
12. Total area covered under plum (ha)
13. Total area covered under peach (ha)
14. Total area covered under apricot (ha)
15. Total yield of apple (tones)
16. Total yield of plum (tones)
17. Total yield of peach (tones)
18. Total yield of apricot (tones)
19. Number of co-operative societies per lakh of population
20. Percentage of forest area to total geographical area
21. Percentage of total forest area in district
22. Total number of cattle
23. Number of buffaloes in district
24. Number of civil veterinary hospitals/CVDs

25. Percentage of electrifying villages
26. Number of post offices per lakh of population
27. Number of primary schools in district
28. Number of Higher secondary schools in district
29. Percentage of literacy (2011, census)
30. Number of hospitals per lakh of population
31. Number of beds in hospitals per lakh of population
32. Number of PHCs in district
33. Number of commercial banks
34. Number of registered working factories
35. Number of workers employed in working factories

#### Method of Analysis

To analyse the patterns of development in various sectors composite index of development for various districts was prepared by using a technique adopted by Narain *et al.* (1991, 1995). Factor analysis and Principal component analysis have been also used to measure the development among the districts.

#### Method of estimation of composite index of development (Narain *et al.*, 1991)

Let  $[X_{ij}]$  be data matrix giving the values of the variables of  $i^{\text{th}}$  district. Where  $i = 1, 2, \dots, n$  (number of districts) and  $j = 1, 2, \dots, k$  (number of indicators). For combined analysis  $[X_{ij}]$  is transferred to  $[Z_{ij}]$  the matrix of standardized indicators as follows

$$[Z_{ij}] = \frac{X_{ij} - \bar{X}_j}{S_j}$$

Where,  $S_j$  = Standard deviation of  $j^{\text{th}}$  indicator  
 $\bar{X}_j$  = mean of the  $j^{\text{th}}$  indicator

From  $[Z_{ij}]$ , identify the best value of each indicator. Let it be denoted as  $Z_{oj}$ . The best value will be either the maximum value or the minimum value of the indicator depending upon the direction of the impact of indicator on the level of development. For obtaining the pattern of development  $C_i$  of  $i^{\text{th}}$  districts, first calculate  $P_{ij}$  as follows

$$P_{ij} = (Z_{ij} - Z_{oj})^2$$

Pattern of development is given by

$$C_i = \left[ \sum_{j=1}^k P_{ij} / (CV)_j \right]^{1/2}$$

Where,  $(CV)_j$  = coefficient of variation in  $X_{ij}$  for  $j^{\text{th}}$  indicator.

Composite index of development (C.I.) is given by  
 $C.I. = C_i / C$  for  $i = 1, 2, \dots, n$

$$C = \bar{C} + 3SD_i$$

Where  $\bar{C}$  = mean of  $C_i$  and

$SD_i$  = Standard deviation of  $C_i$

Smaller value of C.I. will indicate high level of development and higher value of C.I. will indicate low level of development.

#### Principal component analysis

Principal component analysis (PCA) was invented in (1901) by Karl Pearson, as an analogue of the principal axis theorem in mechanics. It is a statistical procedure that uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components. The number of principal components is less than or equal to the number of original variables. This transformation is defined in such a way that the first principal component has the largest possible variance (that is, accounts for as much of the variability in the data as possible), and each succeeding component in turn has the highest variance possible under the constraint that it is orthogonal to the preceding components. The resulting vectors are an uncorrelated orthogonal basis set. Principal component analysis is based on the statistical representation of a random variable. Suppose we have a random vector population  $x$ , where

$$X = (X_1, X_2, \dots, X_n)^T$$

And the mean of that population is denoted by

$$\mu_x = E \{X\}$$

And the covariance matrix of the same data set is

$$C_X = E \{ (X - \mu_X)(X - \mu_X)^T \}$$

The components of  $C_x$  denoted by  $C_{ij}$  represent the covariance between the random variable components  $X_i$  and  $X_j$ . The component  $C_{ij}$  is the variance of the component  $X_i$ . The variance of a component indicates the spread of the component values around its mean value. If two components  $X_i$  and  $X_j$  of the data are uncorrelated, their covariance is zero, i.e.

$$[C_{ij} = C_{ji} = 0]$$

The covariance matrix is always symmetric.

From a sample of vectors  $X_1, X_2, \dots, X_m$ , we can calculate the sample mean and the sample covariance matrix as the estimates of the mean and the covariance matrix.

From a symmetric matrix such as the covariance matrix, we can calculate an orthogonal basis by finding its eigenvalues and eigenvectors. The eigenvectors  $e_i$  and the corresponding eigenvalues  $\lambda_i$  are the solutions of the equation

$$C_X e_i = \lambda_i e_i, i = 1, 2, 3, \dots, n$$

For simplicity we assume that the  $\lambda_i$  are distinct. These values can be found, for example, by finding the solutions of the characteristic equation

$$|C_X - \lambda I| = 0$$

Where,  $I$ , is the identity matrix.

**Factor analysis**

Factor Analysis (FA), however, is a statistical extension of PCA in that a decision is made to discard some of the less significant principal components. This means that the new covariance matrix reconstructed from the retained factors will be an approximation. Factor analysis starts with the basic principal component approach, but differs in two important ways. First of all, factor analysis is always done with standardized data. This implies that we want the individual variables to have equal weight in their influence on the underlying variance covariance structure. In addition, this requirement is necessary for us to be able to convert the principal component vectors into factors. Secondly, the eigenvectors must be computed in such a way that they are normalized, i.e. of unit length or orthonormal.

Suppose we have a set of  $p$  observable random variables, with means  $\mu_1, \mu_2, \dots, \mu_p$

Suppose for some unknown constants  $l_{ij}$  and  $k$  unobserved random variables  $F_j$ , where  $i \in 1, \dots, p$  and  $j \in 1, \dots, k$  where  $k < p$ , we have

$$x_i - \mu_i = l_{i1}F_1 + \dots + l_{ik}F_k + e_i$$

Here, the  $e_i$  are independently distributed error terms with zero mean and finite variance, which may not be the same for all  $i$ . Let  $\text{Var}(e_i) = \psi_i$ , so that we have

$$\text{Cov}(e) = \text{Diag}(\psi_1, \dots, \psi_p) = \Psi$$

And  $E(e) = 0$

In matrix terms, we have  $x - \mu = LF + e$

Also we will impose the following assumptions on  $F$ .

$F$  and  $e$  are independent.

$$E(F) = 0$$

$$\text{Cov}(F) = I$$

Any solution of the above set of equations following the constraints for  $F$  is defined as the factors, and  $L$  as the loading matrix.

Suppose  $\text{Cov}(x) = \Sigma$ . Then note that from the conditions just imposed on  $F$ , we have

$$\text{Cov}(x - \mu) = \text{Cov}(LF + e)$$

or

$$\Sigma - L \text{Cov}(F) L^T + \text{Cov}(e)$$

or

$$\Sigma - LL^T = \Psi$$

Note that for any orthogonal matrix  $Q$  if we set  $L = LQ$  and  $F = Q^T F$ , the criteria for being factors and factor

loadings still hold. Hence a set of factors and factor loadings is identical only up to orthogonal transformations.

**RESULTS AND DISCUSSION**

**Level of Development**

The composite indices of development in respect of all sectors, agriculture & social sectors respectively have been worked out for different districts of Himachal Pradesh. The districts have been ranked on the basis of composite indices. The values of composite indices along with the rank of districts are given in Table 1. The perusal of Table 1 revealed that in overall development, the district Kangra (C.I.=0.00) was found to be the best developed district in the Himachal Pradesh followed by districts Mandi (C.I.=0.02), Sirmour (C.I.=0.16), Shimla (C.I.=0.17) and Solan (C.I.=0.23) whereas the district Lahaul and Spiti (L&S) (C.I.=1.00) was on the last place followed by the districts Kinnaur (C.I.=0.99), Bilaspur (C.I.=0.82) and Hamirpur (C.I.=0.74). Districts Kullu (C.I. =0.38), Chamba (C.I. = 0.51) and Una (C.I. = 0.69) were found to be moderate districts.

In agricultural development the districts Mandi (C.I. = 0.00), Sirmour (C.I. = 0.09), Kangra (C.I. = 0.10) were found to be in most developed districts and districts Kinnaur (C.I. = 1.00), L&S (C.I. = 0.97) and Bilaspur (C.I. = 0.91) were found to be most backward, while in social sector districts Kangra (C.I. = 0.00), Solan (C.I. = 0.01), Shimla (C.I. = 0.10) were found to be most developed and districts L&S (C.I. = 1.00), Kinnaur (C.I. = 0.93) and Bilaspur (C.I. = 0.70) were found to be also most backward in social sector as well as in agriculture sector.

**Different Stage of Development**

A simple ranking of districts on the basis of composite indices would be sufficient for classificatory purposes. A suitable fractile classification of the districts from the assumed distribution of the mean of the composite indices will provide a more meaningful characterization of different stages of development. The fractile groups can be used to classify the various stages of development. For relative comparison, it appears appropriate to assume that the districts having composite index less than or equal to (Mean-SD) are highly developed and these districts are classified in category-I of developed districts and the districts having composite index greater than (Mean+SD) are low developed and are classified in category-IV of low developed districts. Districts with composite index lying between (Mean) and (Mean-SD) are medium level developed and these districts are put in category-II and the districts with composite index lying between (Mean) and (Mean+SD) are classified in category-III as developing districts. Classification of the population on the basis of overall development is given in Table 2.

It may be seen that in case of overall development, two districts are found to be highly developed. About 36.56 percent population of the Himachal Pradesh belongs to these two districts. Four districts are high

**Table 1: Composite indices (C.I.) of development**

Districts	Overall (All Sectors)		Agricultural sector		Social sector	
	C.I.	Rank	C.I.	Rank	C.I.	Rank
Kangra	0.00	1	0.10	3	0.00	1
Mandi	0.02	2	0.00	1	0.22	4
Sirmaur	0.16	3	0.09	2	0.38	5
Shimla	0.17	4	0.30	5	0.10	3
Solan	0.23	5	0.44	6	0.01	2
Kullu	0.38	6	0.22	4	0.67	9
Chamba	0.51	7	0.49	7	0.59	6
Una	0.69	8	0.75	8	0.63	7
Hamirpur	0.74	9	0.82	9	0.65	8
Bilaspur	0.82	10	0.91	10	0.70	10
Kinnaur	0.99	11	1.00	12	0.93	11
L & S	1.00	12	0.97	11	1.00	12

**Table 2: Population at different stages of development**

Stage of development	Overall development of districts	Population (Per cent)
High	Kangra and Mandi	36.56
High middle	Sirmaur, Shimla, Solan and Kullu	34.41
Low middle	Chamba, Una, Hamirpur and Bilaspur	27.34
Low	Kinnaur and Lahaul and Spiti (L&S)	1.69

**Table 3: Ranking of districts based on factor analysis and principal component analysis**

Districts	Factor scores	Rank	PC scores	Rank
Kangra	2.22	1	8.59	1
Mandi	1.31	2	5.10	2
Shimla	0.86	3	3.39	3
Sirmaur	-0.01	4	0.00	4
Solan	-0.06	5	-0.27	5
Hamirpur	-0.20	6	-0.78	7
Una	-0.20	7	-0.65	6
Chamba	-0.21	8	-0.87	8
Kullu	-0.42	9	-1.63	9
Bilaspur	-0.45	10	-1.80	10
Kinnaur	-1.28	11	-5.07	11
L&S	-1.53	12	-5.99	12

middle level development covering the population of about 34.41 per cent and also four districts are low middle development with the population of about 27.34 percent. The Two districts were having lower development as compared to their counterparts, covering only 1.69 percent population. This is striking feature for the state that there is only two districts in the low category which are covered only 1.69% of the population of the state.

### Results based on Factor Analysis and Principal Component Analysis

The districts of Himachal Pradesh have been also ranked on the basis of factor scores and principal component (PC) scores. Factor scores of development have been obtained by using factor analysis and PC scores have been obtained through PCA for different districts of Himachal Pradesh. The districts have been ranked on the basis of factor scores and PC scores. Factor scores and PC scores of development along with the rank of the districts are given in Table 3. The perusal of Table 3 showed that the results of both methods were almost similar, while district Hamirpur was ranked different by both of methods. Kangra, Mandi, Shimla and Sirmaur were the most developed districts by both methods whereas L&S, Kinnaur and Bilaspur were found most backward districts.

### CONCLUSIONS

Disparities in economic and social development across the regions and intra-regional disparities among different segments of the society have been the major planks for adopting planning process in India since independence. This paper has showed how analysis of developmental indicators can be used to search for similarities across districts and get better understanding about situation in the Himachal Pradesh. The results revealed that the districts namely Kangra, Mandi, Sirmaur, Shimla and Solan were better developed in all

sectors. The other three districts viz. L&S, Kinnaur and Bilaspur were found to be low developed in all sectors. The analysis of relationship between agricultural and socio-economic development shows that there is a positive association agricultural and social development in almost all the districts of the state. Entire parts of the low developed districts are not low developed but some parts are high middle or low middle level of development. For enhancing the level of development of low developed districts, model districts have been identified and it would be better to examine and evaluate the level of development at smaller level for making location specific recommendations for improvement of level of development. Based on this evaluation, plan formulation could be made for the different physiographic districts of the state based on their resource potential, levels of development and the objectives of socio-economic equity and regional balance.

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#### Appendix 1: Districts of Himachal Pradesh

S. No.	Districts	S. No.	Districts
1	Bilaspur	7	Lahaul and Spiti (L&S)
2	Chamba	8	Mandi
3	Hamirpur	9	Shimla
4	Kangra	10	Sirmaur
5	Kinnaur	11	Solan
6	Kullu	12	Una



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## **Determinants of Farm Income among Small Holders in Andhra Pradesh**

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### **ABSTRACT**

*The farm study was mainly meant to understand the determinants of income of small rural households in Guntur district of Andhra Pradesh. Multiple linear regression analysis was applied to study the determinants. It was observed that 94 per cent of variability in gross income from farm was explained by the selected independent variables namely age, education, household size, farm size, off farm income, farm expenditure and maintenance cost of dairy. It was found that farm expenditure and dairy maintenance cost showed positive significant influence on farm income at 5 percent level of significance.*

### **Keywords**

Farm expenditure, farm size, off farm income and small farmers

### **JEL Codes**

C81, O13, Q13, Q18

### **INTRODUCTION**

Small holdings (marginal and small holdings) agriculture is important for raising agriculture growth, food security and livelihoods in India. It may be noted that Indian agriculture is the home of small and marginal farmers (80 per cent). Therefore, the future of sustainable agriculture growth and food security in India depends on the performance of those small and marginal farmers (Dev, 2012). At times, small holdings have higher productivity than medium and large farms. But, it is not enough to compensate for the disadvantage of the small area of holdings. The cost of cultivation per hectare is also high on small and marginal farmers than medium and large farms. The fundamental problem Indian farmers are faced with today is the reducing incomes and there is an urgent need to assure income security to them.

At all India level, net farm income per hectare for small holdings found to be higher than large holdings. However, the monthly income and consumption figures across different size class of land holdings show that marginal and small farmers have dis-savings compared to medium and large farmers. The average monthly income of farmer households comprises of income from wages, net receipts from cultivation, net receipts from farming of animals and income from non-farm business

and the average monthly consumption of farmer households is comprised of total food and non-food expenditure (Dev, 2012). Guntur district of Andhra Pradesh covers about 150845 agricultural small farmers (*agriculture census 2010-11*, agcensus.nic.in) and they face several problems like high crop expenditure, few off-farm income sources etc. All these problems may fully or partly affect the viability of small farmers in agriculture. The most appropriate measure of farmers' welfare is the level of farm income and there is not much research in the diversification and determinants of small farm household income. In this context "Determinants of Gross Income from Farm (Crop and Dairy) in Guntur district of Andhra Pradesh" assumes greater significance.

This paper aims at understanding the factors which influence the farm income. The main factors are age, education, household size, farm size, off farm income, farm expenditure and maintenance cost of dairy.

### **MATERIAL AND METHODS**

Multi stage sampling technique was followed for the purpose of selection of primary sampling units. Small holdings technically mean land holdings of less than or equal to two ha which includes marginal (<1ha) and small farmers (1-2 ha). However for the present research, small

farmer (1-2 ha) category of farmers were only considered for the study.

Guntur district was purposively selected for the study due to the availability of more number of small farmers (approximately 150845), who are cultivating different crops under varied agro climatic conditions. Out of fifty seven mandals in Guntur district based on Chief Planning Office data, two mandals with highest number of small farmers were selected from each revenue division. From each mandal, two villages with maximum number of small farmers were selected. Ten small farmers from each village were selected randomly making a total sample of 120 farmers for the study. Three years primary data on various aspects of small farmers from 2012-13 to 2014-15 agricultural years was collected through field survey by the interview and recall memory method with the help of a pre-tested and well-structured schedule.

Both primary and secondary data were collected to fulfill the objective of the study. Data collected were analyzed using Multiple linear regression model of the following form was employed for analyzing the factors influencing farm income (crop and dairy) of small holdings agriculture.

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + e$$

Where

Y = Total farm income (crop and dairy) (Rs.)

X<sub>1</sub> = Age (no.)

X<sub>2</sub> = Education (no.)

X<sub>3</sub> = Household size (no.)

X<sub>4</sub> = Farm size (ha.)

X<sub>5</sub> = Off- farm income (Rs.)

X<sub>6</sub> = Farm (crop related) expenditure (Rs.)

X<sub>7</sub> = Maintenance cost of dairy (Rs.)

a = Intercept

b<sub>1</sub>, b<sub>2</sub>, b<sub>3</sub>, b<sub>4</sub>, b<sub>5</sub>, b<sub>6</sub>, b<sub>7</sub> are the regression coefficients

e = Error term

For testing the regression coefficients 't' value was calculated by using the formula

$$t = b_i / \text{S.E of } b_i$$

Where, b<sub>i</sub> = Regression coefficient or production elasticity coefficient

S.E of b<sub>i</sub> = Standard error of b<sub>i</sub>

## RESULTS AND DISCUSSION

### Investment Pattern Profitability of Small Farms

Below described results are represented the income from both crops and milch animals. Table 1 depicts the values of investment on crops, gross income and net income obtained by sample farmers in Guntur district of Andhra Pradesh.

On an average, chilli occupied highest investment share by farmers than other crops, due to high input costs observed in this crop. Labour charges also increased year by year in the sample area and chilli crop occupied major share in gross income and net income also. In 2013, a single tomato grower found in the sample did not harvest the produce and he left it in the field due to lack of remunerative prices. Therefore sample tomato grower got negative income.

### Maintenance Costs, Gross Income and Net Income of the Milch Animals

Out of 120 sample small farmers, only 47 farmers owned cattle in 2012 and 46 farmers in 2013 and 2014. They reported that the maintenance cost of milch animals was ₹23,036 in 2014, ₹22,753 in 2013 and ₹21,598 in 2012 earning total income of ₹33,168 in 2014, ₹32,120 in 2013 and ₹29,934 in 2012. Average maintenance cost of milch animals was found to be ₹22,462 earning total income of ₹31,741 (Table 2).

Table 1: Average investment, gross income and net income of small holdings on farm from 2012 to 2014

Crop	Average investment		Average gross income		Average net income	
	Amount	Percent	Amount	Percent	Amount	Percent
Paddy	56887	7.68	84566	8.05	27678	8.93
Cotton	81891	11.06	98919	9.41	17028	5.50
Chilli	227529	30.73	315094	30.00	87565	28.26
Jute	32327	4.36	65040	6.20	32713	10.55
Red gram	37474	5.06	76013	7.23	38539	12.43
Tomato	25000	3.37	-	-	-25000	-8.07
Maize	45305	6.11	71416	6.8	26211	8.46
Bengal gram	51215	6.92	74354	7.08	23139	7.47
Sun hemp	11859	1.61	12491	1.19	632	0.21
Black gram	38253	5.17	58592	5.58	20339	6.57
Green gram	33288	4.5	43691	4.17	10403	3.36
Tobacco	94384	12.75	140788	13.41	46404	14.98
Sorghum	5000	0.68	9167	0.88	4166	1.35
<b>Total</b>	<b>740412</b>	<b>100.00</b>	<b>1050131</b>	<b>100.00</b>	<b>309817</b>	<b>100.00</b>

Figures in parentheses indicated percentages to the total

**Table 2: Maintenance costs, gross income and net income of the milch animals**

Particulars	₹/milch animal			
	2014	2013	2012	Average
No. of farmers owned	46	46	47	46
No. of milch animals	85	85	87	86
Maintenance costs	23036	22753	21598	22462
Gross income	33168	32120	29934	31741
Net income	10132	9367	8336	9278

Regarding investment, gross income and profitability, chilli crop occupied major share in comparison to the other crops grown in the district profile under study. Profitability from dairy also increased year by year from 2012 to 2014.

#### Average Household Income of Small Farmers from 2012 To 2014

Table 3 depicts the total family income of small holdings. In Guntur district except Tenali division, remaining two revenue divisions have got lower income.

In Tenali division, farm expenditure found to be low while gross income was more. Small farmers in the division obtained most of their off-farm income from earned income (salaries and wages). Income from dairy is low in Tenali division compared to Guntur and Narsaraopet divisions. But due to decreased farm expenses and increased off farm income sources, they could get more income than the other two divisions. In Guntur and Narsaraopet divisions, income from dairy is more than in Tenali division.

Average house hold income found to be low in the two divisions compared to Tenali because of high farm expenditure. Average off-farm income for Guntur

division is the highest of the three divisions in Guntur district.

Thus diversification helps in supplementing their income by not only undertaking seasonal crop farming but also animal husbandry, fishing, horticulture etc and also participating in industrial and other non-farm economic activities as either self-employed or wage earners.

#### Determinants of Gross Income from Farm (Crop and Dairy)

The perusal of Table 4 depicts the factors influencing farm income (crop and dairy) of small holders. The Co-efficient of Multiple Determination ( $R^2$ ) was 0.94 (significant at 5per cent level) which indicates that 94 per cent of variability in gross income from farm was explained by the selected independent variables namely age, education, household size, farm size, off farm

**Table 4: Determinants of gross income from farm (crop and dairy)**

Particulars	Regression coefficients	Standard errors
Intercept	19847	24346.43
Age (years)	324.88	419.22
Education (years)	-96.46	407.01
House hold size (No.)	-4096.01	2906.43
Farm size (No.)	12353.34	9895.84
Off farm income (₹)	0.013	0.075
Farm expenditure (₹)	1.054**	0.077
Maintenance cost of dairy (₹)	1.053**	0.18
$R^2$	0.94**	

Source: Field Survey

\*\* significant at 5 per cent level

**Table 3: Average household income of small farmers from 2012 to 2014**

Particulars	Revenue Divisions			Overall district
	Guntur	Tenali	Narsaraopet	
<b>a. Agricultural crops</b>				
Gross income	219554	228978	194702	214412
Farm expenditure	185994	167392	152213	168533
<b>Net income</b>	<b>33560</b>	<b>61586</b>	<b>42489</b>	<b>45879</b>
<b>b. Dairy</b>				
Gross income	29401	15192	23463	22686
Maintenance cost	21283	10941	16275	16167
<b>Net income</b>	<b>8118</b>	<b>4251</b>	<b>7188</b>	<b>6519</b>
<b>c. Off-oarm income</b>				
Salary	12625	24433	14900	17320
Farm wages	7733	1883	4233	4617
Non - Farm wages	8428	0	1850	3426
Business	0	0	1083	361
<b>d. Total off-farm income</b>	<b>28786</b>	<b>26316</b>	<b>22066</b>	<b>25724</b>
<b>Household income</b>	<b>70464</b>	<b>92153</b>	<b>71743</b>	<b>78120</b>

income, farm expenditure and maintenance cost of dairy.

It was observed from Table 4 that farm expenditure and dairy maintenance cost showed positive significant influence on farm income at 5 percent level of significance.

Ibekwe *et al.* (2010) showed that farm size, age, education, occupation and hours spent on farm are important explanatory variables that influenced both farm and off farm incomes. Farm size, age, education, occupation and hours spent on farm influenced positively to the farm income at 5per cent significant level. As expected, age, farm size and off farm income though non-significant showed positive influence on farm income.

#### **CONCLUSIONS**

Farm expenditure on chilli is more than the other crops. Gross income and net income also more in chilli. Income from milch animals increased year by year. But number of farmers owned milch animals is very low. Farm expenditure showed significant influence on farm

income followed by maintenance cost of dairy. Whereas age, education, household size, farm size and off farm income were non- significant to the farm income. This revealed that by adding each one unit of farm expenditure will increase the farm income by 1.054 units and the same way by adding each one unit of maintenance cost of dairy will increase the farm income by 1.053 units. Diversification and off farm income sources can only help the farmers to become viable.

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## Economic Analysis of Major Kharif Crops in Chhattisgarh

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### ABSTRACT

Study based on the data collected from eighty farmers who were selected randomly from four villages of Dantewada district. Paddy and maize are the important crops, covered 85 per cent area (62 and 23 per cent) of total kharif cropped area in the district. Study revealed that the average per ha cost of paddy and maize cultivation estimated as ₹13533.63 and ₹17476.64 respectively. The average per ha net returns was estimated as ₹33169.87 and ₹25684.76 respectively. Per farm quantity produced of these crops were estimated 28.67 and 38.30 q/ha. The input-output ratio was estimated as 1:3.45 and 1:2.47.

### Keywords

Cost of cultivation, economics of production, return of kharif crops

### JEL Codes

E23, L11, M31, P22

### Introduction

Agriculture forms the backbone of the Indian economy and agro-based Industries. It contributes, nearly one fourth of the National Gross Domestic Product and sustains livelihood of about two thirds (60 per cent) of population. In agriculture, different crops of cereals, pulses, oilseeds, coarse grains and vegetable are grown alone or together in different seasons. Out of these crops, major kharif cereals that is, rice, minor millets and maize have the greater importance in the food system of Indian economy. Rice is one of the important food crops in the world ranks, second in terms of area and production. It is staple food about 50 per cent of population in Asia where 90 per cent of world's rice grown and consumed. Asia's food security depends largely on the irrigated rice fields, which account for more than 75 per cent of the total rice production. The area under and production of paddy in the world is 163 Mha and 730 Mt during the year of 2012-13 (FAO, 2013).

Maize is important cereal crop in the world agricultural economy both as food for man and feed for animals including poultry. Country like USA, Brazil, China and Mexico are the some important and huge producer of this crop at the global level. It is also known as "queen of cereals" because of very high yield potential. India ranks sixth in global maize production, contributing 2.4 per cent of world production with almost 5 per cent

share in world harvested area. The average productivity of the crop is about 24.70 quintal per hectare against world average of 51.40 quintal per hectare which is about 48 per cent less against the global average.

### Status of Major Crops in India

The total area under paddy cultivation is 43.39Mha in the country during 2015-16 which is 22.05 percent of gross cropped area. The total production of paddy is 104.32Mt which constitutes 43.48 percent of total cereal produced in the country during 2015-16. The export of paddy increased from 3.41Mt during 2003-2004 to 7.18Mt in 2011-12 which shows a drastic increase in export by 110 percent during last one decade. The value of export from this crop was about 4168 cores of rupees in 2003-2004 which increased to about 24109 cores of rupees during 2011-12 (DAC, 2012). The average productivity of paddy is estimated as 2404 kg/ha in the country during 2015-16. Maize stands at second place after paddy in India. The area and production of is 8.91 Mha and 21.81 Mt during 2015-16 which constitutes 4.22 percent and 8.90 percent of gross cropped area and total production of maize respectively in the country. The national productivity of this crop is estimated as 2509 kg per hectare.

### Status of Major Crops in Chhattisgarh state

The major rice growing states in the country are West Bengal, Uttar Pradesh, Andhra Pradesh, Punjab, Tamil

Nadu, Orissa, Bihar & Chhattisgarh which together contribute about 72 per cent of the total area and 76 percent of the total production in the country. The total cultivable area is 4.68Mha in the state of Chhattisgarh. The total area under and the production of paddy is 3.82Mha and 6.09Mt in the state of Chhattisgarh during 2015-16. The average productivity of this crop is estimated as 1597 kg/ha accordingly. The percentage share in area under and production of paddy is estimated as 8.50 and 6.05 of the total area and production of the country. The total share of paddy production in the total cereal in the state is 95 percent which shows that the economy of the state depends on paddy in agriculture sector.

Maize is the second important crop after rice it's because of favourable climatic condition in the state. Maize is extensively grown in Uttar Pradesh, Rajasthan, Madhya Pradesh, Bihar and Karnataka. While largest in Karnataka (3.26 M ha) followed by Madhya Pradesh (1.09 M ha) while the productivity is highest in Andhra Pradesh i.e 6069kg/ha.

#### Objectives

1. To work out the Economic cost and returns of major Kharif crops in the study area.
2. To examine the Aggregate Per Hectare Yield,

Value of Output and Cost of Production of major Kharif crops in the study area.

#### MATERIALS AND METHODS

Out of 27 districts of the state, Dantewada district was selected purposively for the present study. Out of four blocks in the district, two blocks were selected randomly further with two villages was considered from each of the selected blocks for the present study. Primary data were collected from 80 farmers from four villages of selected blocks through personal interview method with the help of pre-structured schedule for the year 2013-14. A sample of 80 respondents (10per cent of the total farmers) was selected randomly, subject to condition that at least 5 respondents shall be included on sample from each of the four categories of farms i.e. marginal up to (>1.0 ha), small (1-2 ha), medium (2-4 ha) and large farmers (above 4 ha). Finally 34, 23, 15 and 8 respondents were selected from marginal, small, medium and large size categories of farms using probability proportionate to size technique.

#### RESULTS AND DISCUSSION

##### Economics and Returns of Paddy Cultivation

It can be seen from the Table 1 that on an average per hectare cost of cultivation of paddy was estimated to be ₹13533.63 which varied from ₹12415.46 per hectare at marginal farms to ₹14897.31 per hectare at large farms

**Table1: Aggregate cost of cultivation of paddy at different size groups of farms**

Particulars	Marginal	Small	Medium	Large	Overall
Family human labour	3151.85 (25.39)	1862.62 (14.61)	1267.70 (9.51)	844.60 (5.67)	1580.45 (11.68)
Hired human labour	3949.62 (31.81)	5601.40 (43.93)	6619.45 (49.65)	6642.09 (44.59)	5954.48 (43.99)
Total human labour	7101.47 (57.19)	7464.02 (58.54)	7887.15 (59.16)	7486.69 (50.26)	7534.93 (55.67)
Bullock labour	664.10 (5.35)	408.88 (3.21)	223.74 (1.68)	161.87 (1.09)	319.43 (2.36)
Machine power	1655.00 (13.33)	2696.26 (21.16)	3151.75 (23.64)	5046.76 (33.88)	3393.32 (25.07)
Seed cost	1279.15 (10.30)	796.12 (6.24)	746.26 (5.59)	816.58 (5.48)	865.52 (6.39)
FYM / Manure	783.76	504.67	342.41	258.99	426.06
Fertilizer	271.55 (2.19)	334.34 (2.62)	371.18 (2.78)	439.58 (2.95)	367.70 (2.72)
Plant protection	176.69 (1.42)	151.87 (1.19)	206.23 (1.55)	253.59 (1.70)	203.22 (1.50)
Irrigation charges	290.41 (2.34)	196.26 (1.54)	196.49 (1.47)	203.24 (1.36)	213.59 (1.58)
Sub-Total	12222.13 (98.44)	12552.42 (98.44)	13125.21 (98.44)	14667.30 (98.45)	13323.77 (98.45)
Land revenue	10.00 (0.08)	10.00 (0.08)	10.00 (0.08)	10.00 (0.07)	10.00 (0.07)
Interest on working capital @ 3per cent	<b>183.33</b>	<b>188.29</b>	<b>196.88</b>	<b>220.00</b>	<b>199.86</b>
<b>Total cost</b>	<b>12415.46</b>	<b>12750.71</b>	<b>13332.09</b>	<b>14897.31</b>	<b>13533.63</b>

Figures in the parentheses indicate the percentages to the total cost of cultivation

respectively. It shows that the cost of cultivation per hectare was increasing as the size of holding increased. The share of major cost on the cultivation of paddy crop was observed as human labour (both family and hired labour) which was estimated about (55.67 per cent) ₹7534.93 per hectare of the total cost of cultivation on which contribution of family human labour and hired human labour was observed 11.68 per cent and 43.99 per cent respectively. Machine power was observed another second important major cost items in the total cost of cultivation. It was estimated as ₹3393.32 per hectare (25.07 per cent) which varied from ₹1655.00 per hectare (13.33 per cent) at marginal farms to ₹5046.76 per hectare (33.88 per cent) at large farms. The next major cost was observed as seed cost. The average cost of seed material was estimated as ₹865.52 per hectare (6.39 per cent) which varied from ₹1279.15 per hectare (10.30 per cent) at marginal farms to ₹816.58 per hectare (5.48 per cent) at large farms respectively. Lack of recommended doses of application and timely availability seems to be a reason behind this fact. The average expenditure increased in these to items was observed to be about 3.15 to 2.72 per cent of the total cost. Not timely supply and high price of these inputs in the area are may be the reasons behind this

fact. Productivity and net return increase significantly. The volume of production and net return will further increases if farmers are to be more causes about application of fertilizer, inter cultural operations and weed managements. (Verma *et al.*, 2010)

#### Cost of Cultivation of Maize

It can be seen from the Table 2 that on an average per hectare cost of cultivation of maize was estimated as ₹17476.64 which varied from ₹14441.19 per hectare at marginal farms to ₹18631.86 per hectare at medium farms respectively. It shows that per hectare cost of cultivation is increasing as the size of holding increased. The share of major cost on the cultivation of maize crop was observed as human labour (both family and hired labour) which was estimated about 41.01 per cent ₹7166.77 per hectare of the total cost of cultivation on which contribution of family human labour and hired human labour was observed 13.13 per cent and 27.88 per cent respectively. Seed cost power was observed another second important major cost in the total cost of cultivation. It was estimated as ₹4024.48 per hectare (21.37 per cent) which varied from ₹3230.76 per hectare (18.75 per cent) at large farms to ₹4859.50 per hectare (26.08 per cent) at medium farms. The next major cost was observed of machine cost. The

**Table 2: Cost of cultivation of maize at different size groups of farms**

Particulars	(₹/ha)				
	Marginal	Small	Medium	Large	Overall
Family human labour	3702.85	2445.45	2089.25	1812.82	2295.03
Hired human labour	2871.39	4645.45	5115.70	5646.15	4871.74
	(19.88)	(26.83)	(27.46)	(32.77)	(27.88)
Total human labour	6574.24	7090.90	7204.95	7458.97	7166.77
	(45.52)	(40.95)	(38.67)	(43.29)	(41.01)
Bullock labour	2357.14	0.00	0.00	0.00	(256.21)
	(16.32)				(1.47)
Machine power	357.14	3750.00	4190.08	4525.64	3734.47
	(2.47)	(21.66)	(22.49)	(26.26)	(21.37)
Seed cost	2742.85	4090.90	4859.50	3230.76	4024.84
	(18.99)	(23.63)	(26.08)	(18.75)	(23.03)
FYM / Manure	685.71	363.63	132.23	102.56	248.45
	(4.75)	(2.10)	(0.71)	(0.59)	(1.42)
Fertilizer	600.85	716.92	868.99	674.03	751.06
	(4.16)	(4.14)	(4.66)	(3.91)	(4.29)
Plant protection	514.28	620.45	644.63	615.38	616.77
	(3.56)	(3.58)	(3.46)	(3.57)	(3.53)
Irrigation charges	385.71	414.77	446.28	358.97	409.94
	(2.67)	(2.39)	(2.39)	(2.08)	(2.35)
Sub-Total	14217.92	17047.57	18346.66	16966.31	17208.51
	(98.45)	(98.46)	(98.47)	(98.46)	(98.46)
Land revenue	10.00	10.00	10.00	10.00	10.00
	(0.07)	(0.06)	(0.05)	(0.06)	(0.06)
Interest on working capital @ 3per cent	<b>213.27</b>	<b>255.71</b>	<b>275.19</b>	<b>254.49</b>	<b>258.13</b>
<b>Total cost</b>	<b>14441.19</b>	<b>17313.28</b>	<b>18631.86</b>	<b>17230.80</b>	<b>17476.64</b>

Figures in the parentheses indicate the percentages to the total cost of cultivation

average cost of machine cost was estimated as ₹3734.47 per hectare (21.37 per cent) which varied from ₹357.14 per hectare (2.47) at marginal farms to ₹4525.64 per hectare (26.26 per cent) at large farms respectively. Manure and fertilizer were the important inputs for any crop cultivation on which farms do not spent more amounts to produce the crops. The average expenditure increased in these to items was observed to be about 1.42 to 4.29 per cent of the total cost. The cost efficiency of maize production in the Chitwan district of Nepal, survey was conducted on 180 maize farmers representing 12 village development committees (VDCs) including one municipality of the district during 2004-2005. Among various factors, use of manure accounted for the highest share in the production cost followed by labour and tractor costs (Paudel & Matsuoka, 2009).

**Aggregate Per Hectare Yield, Value of Output and Cost of Production**

Per hectare of yield value of output per hectare and cost of production per quintal of paddy and maize is given in Table 3. The average cost was estimated to be ₹13533.63 per hectare which varied from ₹12415.46 per hectare at marginal farms to ₹14897.31 per hectare at large farms. Overall on an average yield was observed 28.67 quintal per hectare. The total value of production was varied from ₹42467.05 per hectare at marginal farms to ₹48430.95 per hectare at large farms on an average the gross income was ₹46703.50 per hectare. The average per quintal cost of production is estimated as ₹472.05.

Per hectare of yield value of output per hectare and cost of production per quintal of maize variety is given in Table 3. The average cost was estimated to be ₹17476.64 per hectare which varied from ₹14441.19 per hectare at marginal farms to ₹17230.80 per hectare at large farms. Overall on an average yield was observed 38.30 quintal per hectare. The total value of production was varied from ₹31390.70 per hectare at marginal farms to ₹47902.60 per hectare at large farms on an average the gross income was ₹43161.40 per hectare. The average per quintal cost of production is estimated at ₹456.31.

**CONCLUSIONS**

The results revealed that the overall on an average per hectare cost of cultivation of paddy and maize were estimated to be ₹13533.63 and ₹17476.64 respectively. Overall on an average yield of kharif paddy and maize were 28.67 quintals and 38.30 quintals respectively. Average cost of production per quintal of paddy and maize were worked out to ₹456.31 and ₹481.45 respectively. The input-output ratio of paddy and maize were worked out to be 1:3.45 and 1:2.47 respectively. However, on the basis of cost concept the input – output ratio of paddy and maize were 1:1.79 and 1:1.68 respectively.

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**Table 3: Aggregate per hectare yield, value of output and cost of production**

Particulars	Paddy					Maize				
	Marginal	Small	Medium	Large	Overall	Marginal	Small	Medium	Large	Overall
Input cost (₹/ha)	12415.46	12750.71	13332.09	14897.31	13533.63	14441.19	17313.28	18631.86	17230.80	17476.64
<b>Yield (q/ha)</b>										
a. Main product	26.06	28.38	29.80	29.73	28.67	32.14	34.16	39.68	44.05	38.30
b. By-product	34.03	36.14	37.40	37.71	36.32	28.59	30.12	35.64	40.32	34.38
<b>Value of production (₹/ha)</b>										
a. Main product	41956.60	45691.80	47978.00	47865.30	46158.32	30533.00	34160.00	42060.80	46693.00	42130.00
b. By-product	510.45	542.10	561.09	565.65	544.80	857.70	903.60	1069.20	1209.60	1031.40
Total value of production (₹/ha)	42467.05	46233.90	48430.95	48430.95	46703.50	31390.70	35063.60	43130.00	47902.60	43161.40
<b>Cost of production</b>										
a. Main product	476.42	449.29	447.39	501.09	472.05	449.32	506.83	469.55	391.16	456.31
Output value	42467.05	46233.90	48539.00	48430.95	46703.50	31390.70	35063.60	43130.00	47902.60	43161.40
Net income	30051.59	33483.19	35206.91	33533.64	33169.87	16949.51	17750.32	24768.14	30671.80	25684.76
Input-Output ratio	1:3.42	1:3.63	1:3.64	1:3.25	1:3.45	1:2.17	1:2.03	1:2.35	1:2.78	1:2.47

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## Climate led Vulnerability Assessment vis-à-vis Identification of Rural Problems of Tribal Farmers

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### ABSTRACT

Climate-led Vulnerability Index was calculated as the net effect of exposure and sensitivity on the adaptive capacity by using the 'Integrated vulnerability assessment approach' and IPCC's definition of vulnerability. The weightage of indicators were assigned by using Principal Component Analysis (PCA). The study underlined that 86.25 percent of the selected household have vulnerability index value of less than 0, which indicated that these household were highly vulnerable to climate change because their adaptive capacity is not to such extent to cope up the effect of climate change. In the present study, through Agro-ecological mapping it was found that 90.00 percent households out 299 households were engaged in Agriculture, Animal Husbandry and other allied activities. Total area of the Ogli village is about 292 ha. The land availability per household is 0.63 ha. Major problems and thrust areas were selected by using PRA technique on the basis of bio-physical and socio-economic status of the village.

### Keywords

Agro-ecological analysis, climate-led vulnerability index, pra-techniques, tribal farmers

### JEL Codes

C82, Q54, R51

### INTRODUCTION

The worlds' climate is changing at rates that are projected to be unprecedented in recent human history. Some models are now predicting that the temperature increases by the year 2100 may be larger than previously estimated in 2001 (Thornton *et al.*, 2006). In fact, the area with the richest bio-diversity may be the most vulnerable to the climate change in this way; tribal people and their livelihood are highly sensitive to climatic variations. So, the tribal areas are more vulnerable to climate change i.e. climate change has now come to be considered as one of the most serious long term challenges to be faced by tribal farmers. Climate change is recognized as a significant man-made global environmental challenge. IPCC (1998) defined climate change as a significant shift in the average weather condition especially average temperature and precipitation of an area. Himachal Pradesh is facing the problems due to changing climatic scenario. It comes under one of fifteen agro-climatic zone of India i.e. 'Western Himalaya', so the consequences of climate change can be clearly seen in foot hill region of the state.

In Himachal Pradesh a sizeable population consisting of Hindu and Muslim Gujjars reside. Major occupation of "Gujjar" tribes is dairying, which contribute to economic, social, infrastructural and nutritional security, thus in total to the livelihood security of tribes by providing transport and on-farm power. Dairy animals like buffaloes and cattle, goat and sheep are important species of livestock production systems of the tribes which contribute significantly to the rural economy. Gujjars have poor un-irrigated land holdings in tough terrains and they are mostly illiterate beside these factors they contribute significantly to the main society by providing dairy milk and milk products. Because of their socio-economic status and geographical location they are vulnerable to climate change. The definition of vulnerability, as given by IPCC (2001), was adopted for this study and it is defined as the degree to which a system is susceptible, or unable to cope with adverse effect of climate change, including climate variability and extremes. Vulnerability is the function of the character, magnitude and rate of climate variation to which a system is exposed, its

sensitivity, and its adaptive capacity. Vulnerability may also be due to a particular agro-ecological stability in region, so assessment of agro-ecological situation through the Agro-ecosystem analysis, which is a bottom up approach in analysing location specific problems and remedies concerning development of agriculture based analysis of properties of system by using the participatory rural appraisal tools. Participatory Rural Appraisal (PRA) is the uses of hands on methods such as transect walk, participatory mapping and diagramming resources flows thus help to over-come communication barriers that may exist between outside researchers and community members (Freudenberge, 1999).

## MATERIALS AND METHODS

The present study was undertaken in Himachal Pradesh which have total tribal population is about 15 lakh (24.72 per cent) and schedule tribe population of the state is 3.92 lakh which is predominant in livestock rearing (Chandramauli, 2011). The study was conducted in Sirmour District, at household level and village level. Two village from each block Nahan (Ogli and Khairi) and Paontasahib (Dhaulakuwa and Naurangabad) were purposively selected for primary data collection because these villages have a considerable tribal population. Data were collected from randomly selected 80 household tribal families, 20 families from each village through semi-structured interview schedule. All respondents belonged to recognized "Gujjar" tribes of Himachal Pradesh and having at least one livestock production system. For PRA study, Ogli village was selected, is a methodology for interacting with the villagers, understanding them and learning from them. It involves a set principles a process of communication and a menu of methods for seeking villagers' participation. Total tribal population of selected village was 219 out of which 20 tribal respondents were selected for PRA study.

### Selection of Indicators for Social vulnerability Index

For development of vulnerability index, indicators were selected after that normalization was done by subtracting the minimum value from the observed value and dividing by range using the formula (Maiti et al., 2015; Piya et al., 2012; Gbetibou & Ringler, 2009; Vincent 2004):

$$\text{Normalized value} = \frac{\text{Observed value} - \text{Minimum value}}{\text{Range}}$$

Kaiser (1958)

After normalization, the testing of suitability of indicators and elimination of non-significant indicators was carried out using Principal Component Analysis (PCA). PCA compressed the data by reducing the number of dimensions without much loss of information. After normalization, the covariance matrix was calculated using the formula  $(X-X)^T(X-X)/m$ . Then the Eigen values and Eigen vectors of covariance matrix were computed and the significance of the factors was found

out by Principal Component Analysis (PCA) in SPSS 20 by running the factor analysis for each data set run by choosing PCA for extraction and varimax method for rotation of factors. For the present study cut-off value of the communality values were decided as 0.40 for the household level and indicators were selected accordingly. Factors namely (gender, social migration, education of respondent, awareness about climate change etc.) were dropped from the variable list as the communality values were below the cut-off 0.42.

### Assigning Weights to the Indicators

After selection of suitable indicators, PCA was run again separately for three major components of vulnerability i.e. adaptive capacity, exposure and sensitivity so as to determine the weights by the factor loadings and Eigen vectors were obtained, this method was also adopted by Kolenikov & Angeles (2005); Feroz et al., (2010); Abson et al., (2012) and Maiti et al., (2015). Kaiser normalization was used to identify the Eigen values greater than one. According to the number of Eigen values greater than 1, the same numbers of components were extracted by using varimax rotational method for each indicator as shown in rotational component matrix. Accordingly the initial eigen values above one were identified. Where eigen value was greater than 1, the same numbers of rotated components were extracted for each variable as shown in rotational component matrix. Then, the extracted rotated component matrix was multiplied with the 1<sup>st</sup> extracted component column and 2<sup>nd</sup> Eigen value was multiplied with the 2<sup>nd</sup> extracted component column, considering only absolute values. The values obtained were added in case of each indicator to get weight for that particular indicator. Likewise, weights were obtained for other factors. After calculation of weights, the normalized value of each factors were multiplied by their respective weights to obtain the scale value of each variable of every component. The scale value of each component was calculated by summation of every scale value of variables and scale value of each component (i.e. adaptive capacity, exposure and sensitivity) was divided by the no. variable selected under each component of vulnerability. Thus we had calculated the adaptive index, sensitivity index and exposure index of each household. So for vulnerability index calculation we had applied the following formulae:

$$\text{Vulnerability Index} = \text{Adaptive capacity Index} - (\text{Sensitivity Index} + \text{Exposure Index})$$

## RESULTS AND DISCUSSIONS

### Village transect walk or bio-diversity study

Here transect walk was done from west to east direction in the village along with the Key Informants. The walk was started from the western end of the village. This area contains most of the medium land agricultural fields including residential areas. The tribal village have more no. of buffalo (90 per cent) population and the

population of cattle, goat and sheep is least here. Total population of village is 1492 persons including both male and female, total tribal population of village is 219. Total illiterate person in the village was 500 which about 40 percent of the total population. Most of residential areas fall in Middle of the village. There was no school in the village. One medical shop is there with one doctor. There was one river tribute, tube-well but people are used water from tap water, community level hand-pump and some of them have tank in their home for water storage which was locally known as 'chal'. Village have also a big pond type structure (Kuhl) which is maily used for rain water harvesting. Only two household have tractor and chaff cutter for cutting of green fodder. The inside village mainly have kachha road but it is connected to main daulatpur –amb road by pucca road. In the village, medium of education is only Aaganbadi Cetre and one ASHA worker (Accredited Social Health Activist) is there for health service. This village was well connected to electricity supply.

The majority portion of the village is dominated by uncultivated land which is covered with forest trees like kikar (*Acacia arabica*), bamboo (*Dendrocalamus strictus*), biul (*Grewia optiva*), tuni (*Tuna ciliata*), shisham (*Delbargia sissoo*), khirak (*Celtis australis*), simble (*Bombax ceiba*), Teak, Bamboo, Chil, Oaks, Deodar, Kail, Fir, Spruce, Sal, Banoak, Bana, and Walnut etc. Variety of fruit crop like mango, papaya, citrus, pear,

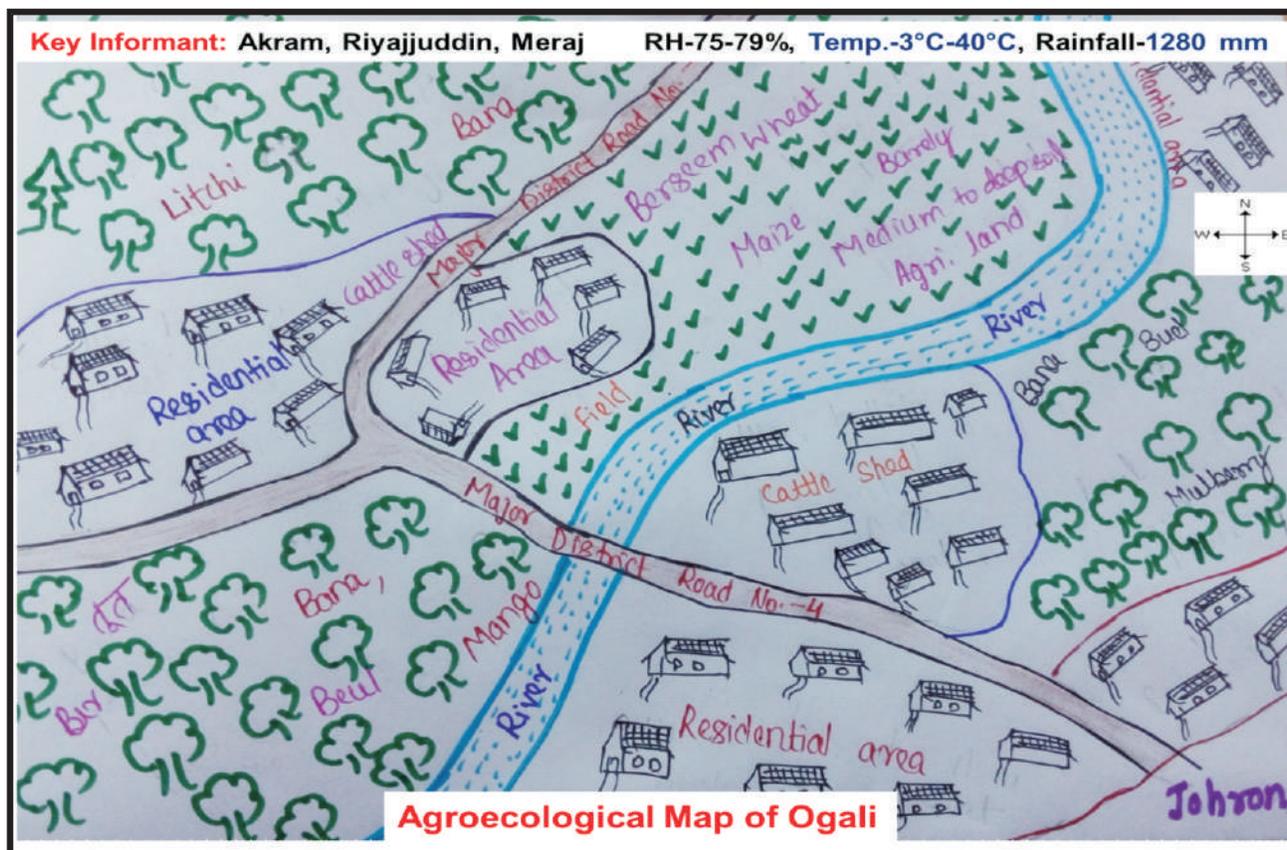
walnut, galgal, guava, litchi, aonla and plum have seen in border area of residential part of the village. The end portion of village is covered by agricultural lands. The villagers mostly cultivate one or two crop in a year. Rain fed farming is most common accounting for more than 87 per cent of the total operational holdings.

### Agro Ecological Mapping

Agro Ecosystem mapping indicates the macro and micro ecological (subsystem) features of a village and basic land use pattern such as agro forestry, social forestry cover and wasteland. This map also helps in preparing perspective planning for the village development. The distribution of high, medium and low land situation can be depicted from the land use map and hydrological map presents the status of water resources available in the form of surface and ground water.

The climate of the area is hot and humid in summer whereas rainy and humid in monsoon season and cool in winter season. Temperature varies from -3.5-40°C with 75-79 per cent relative humidity and mean annual rainfall is 1280 mm. The village has a big natural water preserver (*Chal*), there is no cannel, no tube well in the village. Out of 292 ha land, only 121 ha land is net cultivable. Most of the house of the village is mud house and few are brick house.

There is no distinct forest in the area. The village basically has maize and wheat based farming system such as maize-wheat-maize, maize-rajma-wheat-maize,



maize-vegetables (potato/garlic/onion)-maize, maize-vegetable-mustard. Soil type is medium deep to deep loamy-skeletal soils moderate to severe erosion. There was a small river tribute from which most of the villagers use the water for irrigation, bathing of animals etc.

In upland situation maximum residential area and livestock population are situated. Tap water and community level hand-pump, small size pond (water tank i.e. known as chal) are used for house hold purpose. Crops like maize, wheat, millets, yellow serson and vegetables like tomato, brinjal, lady's finger, leafy vegetables (Spinach), Pudina, potato; spices like ginger, garlic, chilly, onion, fodder like berseem, maize, sorghum, bajra are grown in this village according to season and availability of rain water. Trees like mango, papaya, citrus, pear, walnut, galgal, guava, litchi, aonla and plum have seen in border area of residential part of the village. Trees like palm, date palm and bamboo are common along the village road side.

The cropping intensity of the village is 200 per cent. This can be achieved by the availability of irrigation water collected by rainwater harvesting system and river tributes. Farmer prefers to cultivate maize, wheat, mustard, sesame, brinjal, chilly and fodder crop like sorghum and bajra throughout the year. They are suffering from a lot of problems such as the proper guidance about the insect, disease, weed control, availability quality seed, shortage of labour. Such problems are root and foot rot infection in potato, leaf curl disease in chilli, shoot and fruit borer infestation in brinjal, late blight disease in

potato, leaf curl disease in tomato, fruit and stem rot in pointed gourd.

The profiles of these soils are immature, one or two sandy layers are found. The topography is in generally undulated. The soils of the area are mostly neutral in reaction. The fertility status of soil is low to medium. Ground water potential is also low. The organic matter content of the soil is high.

**Major problems Identified through PRA Tools**

The prioritized specific problems and the proposed actions are shown in Table 1.

**Shortage of drinking water:** Villagers identified inadequate drinking water as the major problem. Various water sources such as spring baoris, nala, and public tap exists in the villages but they are not well-maintained. Water decreases considerably during the summer season.

**Limited irrigation facilities:** Only 14 per cent of the total cultivable land of village is irrigated. Improper distribution system and lack of maintenance of water sources is a main problem. Villagers revealed that lack of irrigation is hindering them from cultivating more crops.

**Problems related to livestock:** The people of Khairi revealed scarcity of fodder; lack of improved breeds and defunct veterinary services as the main livestock associated problems.

**Soil erosion:** Extensive soil erosion is another problem identified by the people in the villages. Undulating topography, existence of slope and lack of adequate grass cover facilitates quick surface run-off and enhances landslides. The problem worsens after rains since

**Table 1: Problems identified through the PRA tools**

Category	Problems
Agricultural problems	1.Unavailability of crop varieties
	2.Unavailability of irrigation facility
	3.Improper agronomic management practices
	4.Inadequate application of manure, bio-fertilizer and Vermicomposting
	5. Same type of cropping sequence year after year in same piece of land
	6. Unavailability of resistance crop varieties
	7. Inadequate knowledge about the disease and insect management practices
	8. Indiscriminate use of chemical fertilizer without soil test based fertilizer application
	9. Decreasing the coverage area and productivity of pulses
	10. Lack of knowledge about maintaining sustainable soil health management
	11. Low land productivity
	12. Lack of proper water harvesting system in the selected village
	13. 40 per cent of crop is destroyed by wild animal
	14. Problems of exotic weeds
	15. Cultivable land decreasing due to extensive soil erosion and landslides
Livestock sector	1. Infertility, disease and low milk production of crossbred and indigenous cow
	2. Low productivity of goat and sheep due to poor management
	3. More disease in animals due to lack of vaccination
	4. Inadequate knowledge about proper livestock management practices
	5. Less productive livestock
	6. Less conception rate through A.I.

extensive run-off washes off huge quantity of top soil.

**Inadequate production of food grains:** Low farm production is another major problem identified by the villagers. Most of the crop is damaged by wild animal attack.

**Health:** Proper vaccination of mother and child is lacking. Lack of awareness regarding health and hygiene is one of the problems in the villages of Khairi.

**Thrust areas Identified through PRA tools**

Technological Interventions as solution for sustainable livelihood security:

**Livestock production management**

- Supplementation of micronutrients
- Improvement and utilization of local feed and green fodder
- Promotion of scientific management in house dairy, goatery, poultry etc
- Popularization of Bio-gas production and use
- To enhance farmer's income through productivity enhancement of livestock
- Care and management of crossbred calf.
- Nutritional management and treatment of anoestrous and repeat breeder cow
- Importance of mineral mixture on milk production of cow
- Care and management of pregnant cows
- Preparation of low cost feed by using locally available ingredients
- Prevention and control measure against disease of cattle.
- Disease and nutritional management of goat.
- Importance of green fodder for livestock. Through prophylaction and vaccination
- Regular check-up of animals by paravets/ veterinary
- Deworming at proper interval of time
- Strengthen of house hold goat rearing
- Improvement of feed resources and nutrient utilization by strengthening existing feeding practices.
- Strategic supplementation of deficient nutrients and ameliorating the ant nutritional factors to improve fertility and milk production of crossbred and indigenous cow
- Intensification of artificial insemination in cattle for breed up-gradation

**Agriculture/horticulture production management**

- Introduction of suitable variety and management strategies for different vegetable crops.
- Soil health management using Integrated Plant Nutrient Management (IPNM) parameters.
- Integrated pest management measures for plant protection measure.
- Introduction of suitable variety and management strategies for different pulses.

- Quality seed and planting materials production.
- Promotion of composite farming like banana/papaya-dairy-poultry.

**Women empowerment**

- Vermicompost production
- Mushroom cultivation and spawn production
- Nursery management
- Paneer/sweet or other dairy products making
- Formation of self-help group

**Small agri-enterprise**

- Production and marketing of vermicompost/paneer/sweets etc.
- Seedling production and marketing.
- Milk collection and marketing
- Processing, grading and packaging units for agri-horticultural produce.

**Value addition**

- Value addition of dairy products
- Production of vermicompost/mushroom

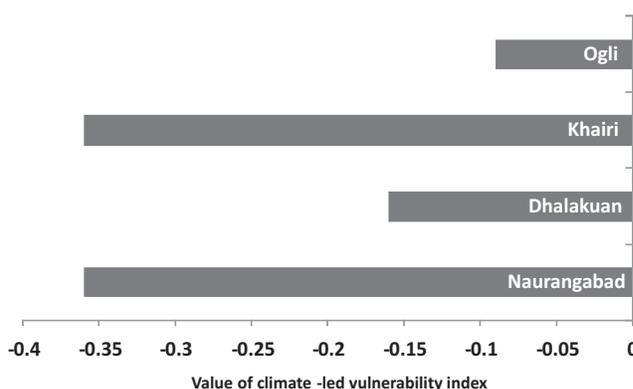
**Risk management**

- Awareness of crop and livestock insurance

**Climate-led Vulnerability Index of Tribal Farmers**

Indices for adaptive capacity, exposure and sensitivity were separately calculated, as described in methodology section, and overall vulnerability index was calculated by subtraction of sum of exposure and sensitivity from the adaptive capacity. Index score of the studied household is presented in Table 2.

Household with higher negative score of vulnerability index are more vulnerable; however positive score of vulnerability index does not mean that household are not vulnerable at all; it just means that these household are comparatively less vulnerable. The perusal of Table 2 revealed that 13.75 percent of the total respondent is moderately vulnerable to climate changes as their social vulnerability index is between 0-1. On the other hand most of the household (86.25 per cent) had social vulnerability index value less than 0, this shown that they are highly vulnerable to climate change because their adaptive capacity is not to such extent to cope up the



**Figure 1: Vulnerability index value of each selected village**

**Table 2: Climate-led vulnerability index value of each selected respondents**

Respondents I.D.	AC scale value	Sensitive scale value	Exposure scale value	AC index	S index	E index	Vulnerability index
1.1.1	15.22	4.82	7.50	0.69	0.48	0.62	-0.41
1.1.2	18.86	5.69	7.67	0.86	0.57	0.64	-0.35
1.1.3	13.35	3.83	7.67	0.61	0.38	0.64	-0.41
1.1.4	12.90	3.29	7.83	0.59	0.33	0.65	-0.40
1.1.5	14.45	5.30	7.67	0.66	0.53	0.64	-0.51
1.1.6	12.52	4.26	7.33	0.57	0.43	0.61	-0.47
1.1.7	17.38	4.93	7.33	0.79	0.49	0.61	-0.31
1.1.8	18.96	4.82	7.33	0.86	0.48	0.61	-0.23
1.1.9	17.27	4.72	7.50	0.79	0.47	0.62	-0.31
1.1.10	19.02	5.00	7.50	0.86	0.50	0.62	-0.26
1.1.11	16.59	5.16	7.50	0.75	0.52	0.62	-0.39
1.1.12	13.63	4.04	7.17	0.62	0.40	0.60	-0.38
1.1.13	14.90	4.10	7.50	0.68	0.41	0.62	-0.36
1.1.14	16.38	5.00	7.50	0.74	0.50	0.62	-0.38
1.1.15	18.72	4.90	7.33	0.85	0.49	0.61	-0.25
1.1.16	16.32	3.65	7.67	0.74	0.36	0.64	-0.26
1.1.17	19.18	5.89	7.33	0.87	0.59	0.61	-0.33
1.1.18	15.72	4.01	7.33	0.71	0.40	0.61	-0.30
1.1.19	15.21	4.49	7.83	0.69	0.45	0.65	-0.41
1.1.20	24.24	7.20	7.67	1.10	0.72	0.64	-0.26
1.2.1	24.97	5.14	7.33	1.13	0.51	0.61	0.01
1.2.2	29.31	6.82	7.17	1.33	0.68	0.60	0.05
1.2.3	13.35	3.83	7.67	0.61	0.38	0.64	-0.41
1.2.4	12.90	3.29	7.83	0.59	0.33	0.65	-0.40
1.2.5	25.64	5.27	7.33	1.17	0.53	0.61	0.03
1.2.6	22.86	5.29	7.17	1.04	0.53	0.60	-0.09
1.2.7	21.57	4.87	7.83	0.98	0.49	0.65	-0.16
1.2.8	33.67	9.38	7.33	1.53	0.94	0.61	-0.02
1.2.9	26.25	6.82	7.17	1.19	0.68	0.60	-0.09
1.2.10	27.77	6.82	7.17	1.26	0.68	0.60	-0.02
1.2.11	24.97	5.14	7.33	1.13	0.51	0.61	0.01
1.2.12	27.20	4.87	7.50	1.24	0.49	0.62	0.12
1.2.13	20.52	6.84	7.50	0.93	0.68	0.62	-0.38
1.2.14	22.81	6.39	7.33	1.04	0.64	0.61	-0.21
1.2.15	19.58	5.98	7.00	0.89	0.60	0.58	-0.29
1.2.16	17.27	4.72	7.50	0.79	0.47	0.62	-0.31
1.2.17	19.02	5.00	7.50	0.86	0.50	0.62	-0.26
1.2.18	16.38	5.00	7.50	0.74	0.50	0.62	-0.38
1.2.19	24.12	6.25	7.67	1.10	0.62	0.64	-0.17
1.2.20	22.02	6.33	7.33	1.00	0.63	0.61	-0.24
2.1.1	19.35	5.95	7.67	0.88	0.59	0.64	-0.35
2.1.2	20.68	8.05	7.33	0.94	0.80	0.61	-0.48
2.1.3	14.48	5.75	7.50	0.66	0.57	0.62	-0.54
2.1.4	20.77	7.90	7.67	0.94	0.79	0.64	-0.48
2.1.5	19.02	7.71	7.50	0.86	0.77	0.62	-0.53
2.1.6	23.04	6.99	7.50	1.05	0.70	0.62	-0.28
2.1.7	24.80	6.94	7.50	1.13	0.69	0.62	-0.19
2.1.8	20.06	5.59	7.83	0.91	0.56	0.65	-0.30
2.1.9	26.17	7.80	7.67	1.19	0.78	0.64	-0.23
2.1.10	23.20	7.02	7.50	1.05	0.70	0.62	-0.27
2.1.11	23.01	7.57	7.83	1.05	0.76	0.65	-0.36
2.1.12	23.22	7.20	7.83	1.06	0.72	0.65	-0.32

Cont...

2.1.13	25.01	8.71	7.33	1.14	0.87	0.61	-0.35
2.1.14	28.71	7.59	7.33	1.31	0.76	0.61	-0.07
2.1.15	22.23	7.56	7.67	1.01	0.76	0.64	-0.38
2.1.16	22.70	7.29	7.67	1.03	0.73	0.64	-0.34
2.1.17	19.33	7.87	8.00	0.88	0.79	0.67	-0.58
2.1.18	21.02	7.90	7.50	0.96	0.79	0.62	-0.46
2.1.19	25.09	7.30	7.50	1.14	0.73	0.62	-0.21
2.1.20	22.01	9.88	7.67	1.00	0.99	0.64	-0.63
2.2.1	19.35	5.95	7.67	0.88	0.59	0.64	-0.35
2.2.2	30.85	4.17	7.83	1.40	0.42	0.65	0.33
2.2.3	19.18	5.89	7.33	0.87	0.59	0.61	-0.33
2.2.4	15.72	4.01	7.33	0.71	0.40	0.61	-0.30
2.2.5	15.21	4.49	7.83	0.69	0.45	0.65	-0.41
2.2.6	22.35	6.07	7.50	1.02	0.61	0.62	-0.22
2.2.7	22.14	5.05	7.50	1.01	0.50	0.62	-0.12
2.2.8	21.10	4.58	7.50	0.96	0.46	0.62	-0.12
2.2.9	25.24	7.14	7.33	1.15	0.71	0.61	-0.18
2.2.10	27.13	4.70	7.50	1.23	0.47	0.62	0.14
2.2.11	27.77	6.82	7.17	1.26	0.68	0.60	-0.02
2.2.12	24.97	5.14	7.33	1.13	0.51	0.61	0.01
2.2.13	27.58	4.87	7.50	1.25	0.49	0.62	0.14
2.2.14	22.44	5.74	7.67	1.02	0.57	0.64	-0.19
2.2.15	21.30	6.00	7.83	0.97	0.60	0.65	-0.28
2.2.16	27.58	4.87	7.50	1.25	0.49	0.62	0.14
2.2.17	22.14	5.05	7.50	1.01	0.50	0.62	-0.12
2.2.18	23.04	6.99	7.50	1.05	0.70	0.62	-0.28
2.2.19	19.18	5.89	7.33	0.87	0.59	0.61	-0.33
2.2.20	40.68	3.79	7.50	1.85	0.38	0.62	0.85

(AC- adaptive capacity, S-sensitivity and E-exposure)

effect of climate change. Among selected village, Khairi village of Nahan block was highly vulnerable and Ogli village was less vulnerable to climate change means it indicates that Khairi village have less adaptive capacity than Ogli.

## CONCLUSIONS

Due to extreme variation in elevation, the climatic scenario of study area is more uneven. The livelihoods of tribal communities in the study area have traditionally been dependent on the dairy sector which is vulnerable to climate change. Ecosystem and climate are two important determinants for survival of any living beings in the study area. The PRA tools helped to make in depth participatory analysis for bringing out new emerging issues and problematic areas within the village which may utilize by the villagers for sustainable agriculture development. In the selected village, the irrigation facility was not available and the tribal farmers were totally rain dependent and at same time there was a great problem of marketing of agricultural and dairy products prepared by tribal farmers within village. The village have poor medical facility. Through social vulnerability assessment,

the researcher have been clearly depicted that 86.75 per cent households are highly vulnerable to climate change means they have weak adaptive capacity to cope up the impacts and effects of changing climate. So the government and policy makers should have to launch the plan to increase the adaptive capacity of tribal farmers in the study area by increasing their income and also should take the steps to mitigate the problem identified by researcher.

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## Mitigating Cancer Mortality in Punjab: A Challenge for Development

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### ABSTRACT

Punjab, once known for its prosperous agricultural and hard-working peasantry, has now infamously got the label of cancer capital of India. A spate of environmental factors in the post green revolution period contributed towards the development of cancer, apart from the genetics and dietary factors. Punjab recorded the highest cases in cancer among the states of India. Realizing the grim health scenario prevalent in Punjab, the present study was undertaken with specific objective to gauge the prevalence of and mortality due to cancer in all three regions of Punjab. The study was based on the secondary data procured from various government sources. The study analyzed the region wise data pertaining to cancer. In Punjab, Malwa region which once was known as cotton belt has been renamed as cancer belt with highest prevalence per lakh (93.4) compared to Majha region (64.7) and Doaba region (88.1). So was the scenario of mortality with highest in Malwa (143.9), followed by Majha (101.2) and Doaba region (136.4). To mitigate the problem, Punjab state government had initiated a three pronged approach for prevention, diagnosis and treatment of cancer. Under Mukh Mantri Punjab Cancer Raahat Kosh, Government of Punjab earmarked Rs. 50.00 crores for the treatment of all cancer patients.

### Keywords

Cancer, mortality, prevalence

### JEL Codes

H53, I18, I38

### INTRODUCTION

Cancer is not a single disease; it is a generic term that refers to more than one hundred distinct type of cancers, and each one is defined by its anatomic site and microscopic features (Barnum & Greenberg, 1993). It is defined as an uncontrollable growth of abnormal cells within the human body. A spate of environmental factors contributes towards the development of cancer, apart from the genetics and dietary factors (Singh, 2008). Carcinogens vary between geographical locations, since their prevalence often depends on local practices. Causes for cancers can be both either internal factors like inherited mutations, hormones and immune conditions or dietary and environmental factors such as tobacco, diet, radiation and other infectious agents. A significant variation of cancer has been reported due to life styles and food habits (Kishore *et al.*, 2008; Kaur & Kaur, 2016).

Punjab as an agrarian economy has gained the benefits of agricultural development, but it has to pay the price for this development. Green Revolution undoubtedly transformed Indian economy from food importing to food

exporting economy and Punjab got honor of the "Bread Basket of India". Due to it, there was also an improvement in the financial conditions of the farmers. But, at same time, it resulted in many ecological problems such as ground water depletion, soil salinity, soaring in soil and water pollution etc. which caused various types of health problems. Worldwide, the ground water quantity and quality has been the first victim of this agricultural revolution; the next are the human health and the extinction of species (Singh *et al.*, 2013; Thakur *et al.*, 2008).

According to WHO, Cancer has doubled its grip over the world in the last 20 years and struck deep roots in India, from 800,000 lives in 2001 to 3.3 million in 2014. It is also reported that 70 per cent of the cancer deaths are taking place in developing countries where India ranked fifth (Dutta, 2014). As per WHO report 2003, the global cancer rate may increase to 15 million by 2020 (WHO, 2003). Punjab with 90 cancer patients for per lakh population crosses the national average of 80 per lakh (Padhi, 2012; Times of India, 2013). Of late, Punjab

which enjoyed the status of “Food Bowl of Nation”, has become infamous for wide spread prevalence of cancer to the extent that it is been referred to “Cancer Bowl” at various platforms. Cancer prevalence (per million) is 1089 in the *Malwa* region, 647 in *Majha* region and 881 in *Doaba* region.

In spite of a good deal of scientific advancement in fields of diagnosis and treatment, threat of cancer looms large on Punjab in general and rural Punjab in particular. Cancer is a great threat not only to health of the person concerned but it plays havoc with the whole family of the victim. It not only disturbs the socio-economic fabric of the family but dwindles the whole development status. To meet the financial cost and repay the financial debt, the households suffering from cancer have to cut down their own essential needs. Development status of individual and family got affected, if one had to sacrifice one or more of the essential components of quality of life i.e. food, clothing, housing, education, health and social ceremonies (Singh *et al.*, 2013; Parkin *et al.*, 2001). Women and elderly (constituting the marginalized) have to bear the worst brunt of expenditure cut, that in turn affect their quality of life and capacity to earn income. Next sufferers constitute the young in the family whose education has to be compromised, for the want of funds, which further results in the onset of vicious circle of human resource underdevelopment as it worsely affects their capacity building. Studies highlighted that prolonged illness (mostly cancer), constituted one of the important economic reason besides indebtedness which has compelled farmers to commit suicide (GOP 2007). In the absence of health insurance system and meager own savings, cancer victim families have to depend on outside sources of finance (Singh *et al* 2013).

Its ever rising magnitude and horrendous impacts in the form of indebtedness, opting the path of self-destruction by victims has compelled the state government to come up with intervention approaches in order to mitigate the alarming situations. Hence, realizing the gravity of the situation, the state government has risen

to the occasion and has come up with various state initiatives for prevention and care. The present research paper is an endeavor to gauge the state initiatives, with specific objective to study the prevalence of cancer and mortality in all the three regions of Punjab.

#### **DATABASE AND METHODOLOGY**

The present study is based on the secondary data procured from various sources. Government of Punjab and National Cancer Control Programme provided data base for region wise analyzes of number of cancer patients and mortality due to cancer. National Cancer Registry Programme was also referred to. The various state interventions for cancer control were also studied through above mentioned sources.

#### **RESULTS AND DISCUSSIONS**

The study gauged the inter region and intra-region differentials as for prevalence of cancer and mortality due to cancer was concerned.

##### **Cancer in Malwa Region**

The Malwa region belonging to Punjab lay in between the rivers Sutlej and Yamuna which is highly fertile. The perusal of Table 1 clearly shows that out of that 10 districts constituting the Malwa region, Shri Muktsar Sahib recorded the maximum (136.6 per lakh) prevalence of cancer cases. Close to Shri Muktsar Sahib was the districts of Faridkot (134.6) and Bathinda (125.8) which recorded cancer prevalence much more than the average of Malwa region (93.4). District with low prevalence were Patiala (86.6) and Moga (88.4). Cancer mortality was recorded for each district for the last five years. Districts which recorded highest cases of cancer prevalence also recorded highest mortality due to cancer as is evident for the data. Shri Muktsar Sahib had cancer deaths of 207.4 per lakh population recorded in the last five years.

##### **Cancer in Majha region**

Majha region is also known as the 'Upper Bari Doab', this region is surrounded by three rivers; Ravi in the west, Beas in the east and Sutlej in the south. It consists of four districts; Amritsar, Gurdaspur, Pathankot, Tarn Taran with

**Table 1: Cancer in Malwa Region**

<b>District</b>	<b>Population covered</b>	<b>No. of death cases due to cancer in last five years</b>	<b>Cancer prevalence (per lakh population)</b>	<b>Cancer deaths (per lakh population)</b>
Barnala	595461	780	98.7	131.0
Bathinda	129368	2058	125.8	159.1
Fatehgarh Sahib	553290	924	106.3	167.0
Ferozepur	1875020	2461	113.9	131.3
Faridkot	583105	1112	134.6	190.7
Moga	949708	1674	88.4	176.3
Mansa	781128	1212	134.8	155.2
Muktsar	863611	1791	136.3	207.4
Patiala	1743623	1496	86.8	85.9
Sangrur	1587170	2284	93.4	143.9
Malwa Region	10825744	42942	93.4	143.9

Source: GOP, 2013

population of 59.1 lakh (GOP 2013). The perusal to Table 2, highlights maximum death cases due to cancer in last five years in Majha region of Punjab was in Amritsar (119.6) followed by Gurdaspur (92.5) and Tarn Taran (81.4). Cancer prevalence was also highest in Amritsar (81.2).

### Cancer in Doaba Region

The region of Punjab called as Doaba lies between the two rivers Sutlej and Beas in its surroundings. "Doaba" has a literal meaning "land of two rivers". The fertility of this land is also high and therefore it was the centre for the Green Revolution. It is evident from the Table 3 that Jalandhar district of Doaba region recorded the highest (124.6) deaths due to cancer in last five years followed by Kapurthala (139.5), Hoshiarpur (124.6) and SBS Nagar (86.5). However, cancer prevalence was highest in Kapurthala district (99.1), followed by Jalandhar (82.3) and Hoshiarpur (86.9).

### Government Initiatives for Cancer Mitigation: Prevention, Diagnosis and Treatment

In order to mitigate the situation created due to unprecedented increase in cancer, the Punjab state government had initiated a three pronged approach for prevention, diagnosis and treatment of cancer.

#### Initiative for Cancer Mitigation through Prevention

Government of Punjab has initiated various measures

to reduce the risk of cancer among the citizens of the state. It is evident from the Table 4 that testing of heavy metals in drinking water has been started in the State Public Health Laboratories. Realizing that scenario of cancer prevalence being worst in Malwa region compared to Majha and Doaba, the State Government has spent a sum of ₹34.00 Crore for installation of Reverse Osmosis Systems (RO) in villages of the 4 districts viz. Muktsar, Mansa, Bathinda and Faridkot of Malwa region where the quality of drinking water was poor. In order to further mitigate the prevalence of cancer and counter the ill effects of pesticides on health, the Department of Agriculture has issued clear direction for the controlled use of pesticides and insecticides. This had resulted in the decline of pesticide consumption from 5975 metric tonnes in 2006-07 to 5690 metric tons in 2010-11. Genetically modified pest resistant crops especially Bt. Cotton is another efforts for this region in this direction. The use of some dangerous pesticides like Aldicarb, Aldrin, BHC, Captafol, Chlordane etc. had been restricted.

#### Initiative for Cancer Mitigation through Diagnosis

Various studies have established that if cancer got detected at early stage (first stage), the chances of cure are significantly higher. In order to mitigate the ever rising cases of cancer, Punjab state has started a project

**Table 2: Cancer in Majha region**

District	Population Covered	No. of death cases due to cancer in last five years	Cancer Prevalence (per lakh population)	Cancer deaths (per lakh Population)
Amritsar	2303022	2755	81.2	119.6
Gurdaspur	2274676	2105	59.9	92.5
Tarn Taran	1141993	930	40.9	81.4
Majha Region	5719691	5790	64.7	101.2

Source: GOP, 2013

**Table 3: Cancer in Doaba region**

District	Population covered	No. of death cases due to cancer in last five years	Cancer Prevalence (per lakh population)	Cancer deaths (per lakh Population)
Hoshiarpur	1554042	1937	86.9	124.6
Jalandhar	2034683	3249	87.3	159.7
Kapurthala	828641	1156	99.1	139.5
SBS Nagar	633756	548	79.4	86.5
Doaba Region	5051122	6890	88.1	136.4

Source: GOP, 2013

**Table 4: Initiative for Cancer Mitigation through Prevention**

Initiatives	Amount spent
State Public Health Laboratories	Started testing heavy metals in drinking water.
Installation of ROs	Reverse Osmosis Systems (RO) costing Rs. 34.00 Crore had been installed.
Health education activities	Organized State level function on "National Cancer Awareness Day" at Mansa District on 7th Nov 2010. "Special Cancer Awareness Campaign" was carried out from time to time. "Mass cancer screening" for Cancer detection was organized in all district hospitals of Punjab.

identifying cancer patients. For this two Cancer Registries has been started by the state government. One is Population Based Cancer Registry (PBCR) and another is Hospital Based Cancer Registry (HBCR). ICMR (Indian Council of Medical Research) has funded a project of Population Based Cancer Registry at the cost ₹45.00 lakhs at Government Medical College and Hospital, Patiala (Table 5). The college is entrusted with the responsibility of maintaining the records of cancer patients. Postgraduate Institute of Medical Education and Research (PGI), Chandigarh is maintaining another cancer registry which is Hospital Based. They maintain the record of cancer patients in hospital. State funded mammography units have been installed at Civil Hospitals in Bathinda, Patiala, Jalandhar and Hoshiarpur.

#### **Initiative for Cancer Mitigation through treatment**

Victims of cancer can get financial assistance for cancer treatment under various government aided schemes. Punjab Nirogi Society provides financial assistance under State Illness Fund to cancer patients and patients of other life threatening diseases. Patients belonging to BPL families can only avail the benefit of the scheme. Government employees and those having health insurance cover are not illegible for availing the benefit under the said scheme. Scheme provided an amount of ₹20.00 crore to all cancer patients in year 2012-2013.

School children suffering from cancer are provided free treatment by State Health Department. So far, 171 children suffering from cancer had been referred to PGI, Chandigarh and 88 children to Mohan Dai Oswal Cancer

Hospital, Ludhiana. State Health Department had spent an amount of ₹189.72 lakhs on their treatment. A brachytherapy machine had also been installed at Government Medical College & Hospital, Patiala for treating cancer victims. State had allocated ₹6.00 crore for Tertiary Cancer Centre at Government Medical College and Hospital, Faridkot out of which ₹4.80 crore had been released (Table 6).

National Program for Prevention and Control of Cancer, Diabetes, Cardiovascular diseases & Stroke (NPCDCS) has also taken initiatives for treatment of cancer. The program has identified three districts viz., Bathinda, Hoshiarpur & Mansa under this program. Under this program Day Care Chemotherapy & Mammography of the patients are done free of cost. NCD Cell also monitors the activities of cancer component in terms of financial requirements & overall functioning under NPCDCS.

Under Mukh Mantri Punjab Cancer Raahat Kosh, Government of Punjab earmarked ₹50.00 crores for the treatment of all cancer patients. An amount of 1.50 lakhs was promised for treatment of each cancer patient. Government employee and those having health insurance cover are not illegible under this scheme. The status report of cancer assistance under Mukh Mantri Punjab Cancer Raahat Kosh (Table 7) was indicative of the fact that during the reference period, 6027 cancer patients had availed this assistance which was comparatively low compared with the actual number of cancer patients in the state. With significant inter districts variations, Jalandhar and Gurdaspur received ₹132409 and ₹130825

**Table 5: Initiative for cancer mitigation through diagnosis**

<b>Diagnosis of cancer</b>	<b>Amount spent (₹ lakhs)</b>	<b>Initiatives</b>
Mammography units	-	Established at Civil Hospitals in Bathinda, Patiala, Jalandhar and Hoshiarpur.
Two Cancer Registries has been started: <ul style="list-style-type: none"> <li>• PBCR</li> <li>• HBCR</li> </ul>	45.00	Concerned with maintaining the information of cancer patients seen in particular hospital.

**Table 6: Initiative for cancer mitigation through treatment**

<b>Programme</b>	<b>Initiatives</b>	<b>Amount spent (₹ crores)</b>
Punjab Nirogi Society	Provide financial assistance to BPL families only.	20.00
Free treatment for school children.	Free treatment for school children in PGI, Chandigarh and Mohan Dai Oswal Hospital, Ludhiana	189.72
NPCDCS (National Program for Prevention and Control of Cancer, Diabetes, Cardiovascular diseases & Stroke).	Day Care Chemotherapy & Mammography of the patients will be done free of cost.	6.00

*Source: GOP, 2013*

**Table 7: District-wise cases of cancer assistance under Mukh Mantri Punjab Cancer Raahat Kosh (as on 31.12.2012)**

District	Number of applications	Number of cases sanctioned	Total amount (₹)	Amount per case (₹)
<b>Malwa</b>				
Barnala	194	194	18597349	95,863
Bathinda	509	509	53102176	104,326
Fatehgarh Sahib	90	90	10175650	113,063
Faridkot	266	266	27436654	103,145
Ferozepur	443	443	42006828	94,824
Ludhiana	622	622	61504134	98,881
Mansa	232	232	22107940	95,293
Moga	288	288	28971501	100,595
Muktsar	265	265	27211448	102,685
Patiala	290	290	32203301	111,046
Sangrur	412	412	41364042	100,398
Roopnagar	56	56	4047860	72,283
SAS Nagar (Mohali)	54	54	6136800	113,644
<b>Majha</b>				
Amritsar	593	593	72602137	122,432
Gurdaspur	509	509	66589706	130,825
Tarn Taran	332	332	33560809	101,087
Pathankot	6	6	772600	128,767
<b>Doaba</b>				
Hoshiarpur	237	237	22946942	96,823
Jalandhar	395	395	52301590	132,409
Kapurthala	145	145	17107604	117,983
SBS Nagar	89	89	8638092	97,057
<b>Total</b>	<b>6027</b>	<b>6027</b>	<b>649385163</b>	<b>107,746</b>

Source: GOP, 2013

respectively while patients at Roopnagar and Mansa got ₹72283 and ₹95293 respectively.

### CONCLUSIONS

There is no doubt that Punjab is considered as a 'Development state' but it sees that to sustain the same level of development in the years to come will be difficult and more challenging. Ulrich Beck, the German sociologist, has rightly argued that the risks which we encounter today derive less from natural dangers than from uncertainties created by our own social development by the development of science and technology. The central issue in pre-Green Revolution period was sustenance and impetus was on growth and development. But now the central issues are various risks i.e. risk to soil, water, air and their impact on socio-economic structure and their manifestations in the form of various health hazards, broken and distressed families. The challenge ahead is how to minimize these risks and to social and healthy physical environment for ourselves and future generations. Answer to these steps can prepare the ground for a sustainable agriculture in years to come.

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## **Income at the Cost of Education-A Study of Child Labour in Agricultural Tool Making Units in Punjab**

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### **ABSTRACT**

*Child labour is the form of work which is detrimental to the development of the child. Industrialization leads to migration of labour, including child labour from rural to urban area to be employed in agriculture, factories, etc. This deprives the working child of his basic right to education. Moreover, the children are also not encouraged to go to school and being illiterate their parents know that it will reduce their income on one hand and will add to their cost on the other. Keeping in view the issue, a study was carried out in 31 agricultural tool –sickle making units in Mandi Ahmedgarh in Sangrur district of Punjab by taking 102 children below the age of 14 years of age, who were found working as labour there. The results of the study revealed that only 13.73 percent of the working children engaged in the sickle making units were going to school, while majority i.e. 86.28 percent of them were not going to school. Out of those who were not going to school, 48.30 percent had never been enrolled in any school and 38.24 per cent were the drop outs. In case of total 49 working children those had never enrolled to any school, 83.67 percent were migrated and 16.33 percent were the native of Punjab. These children were found contributing a negligible amount of income to their families. The children had no interest in studies and were either the drop outs or had never been enrolled to school and ultimately started doing the labour. In this way the study found that about half of the working children were illiterate. The study suggests that night classes should be started in or around rural areas to provide education to the working children as majority, 62.22 percent of them were interested to attend non formal classes at night, if being provided.*

### **Keywords**

Child labour, dropouts, right to education, school going children

### **JEL Codes**

J4, J13, J24

### **INTRODUCTION**

Child labour is the form of work which is detrimental to the development of the child. It was never a problem till children were used just as helping hands. The need to produce more at cheaper cost and the motive to earn more and more resulted in using the helping hands as working hands. The advent of industrialization caused the evil of child labour. Industrialization leads to migration of labour, including child labour from rural to urban area to be employed in agriculture, factories, mines, etc. who exploit the child labour to minimize the costs and maximize profit (Goyal, 2015). Child labour is mainly necessitated by economic compulsions of the parents. It is the outcome of poverty and a scar to human conscience and dignity. Apart from poverty, there are numerous other factors which give rise to child labour. Unemployment and under employment among the poor strata of

population *inter alia*, due to sharp growth of population is also responsible for it. Large families with low income, chronic illness as well as death of bread winner, lack of education facilities, illiteracy and ignorance of the parents about the importance of education as well as about the impact of labour on the health of their children are some of the reasons which breed child labour.

Child labour in a narrow sense is the employment of children in gainful occupation which is hazardous to their health and development. United nations defines child labour as any work that is likely to interfere with child's education as a fundamental human right of 5-14 age group and is of the opinion that, 'any child out of school is a child labour' (ILO,1998). It means that the child labour is a working child who is not attending the school during the day and working under an employee or is learning some trade as an apprentice. Therefore, child labour in a broader

sense may be defined as a child who is deprived of the right to education and childhood (ILO, 1986). When the child is engaged in some work that exploits him and endangers his health and safety, when he is required to work beyond his physical capacity, his wages are not as per the quantum of work done, and work interferes his recreation, rest and above these all the basic right to education is called as child labour (Government of India, 1979). In spite of the government's efforts to creating sufficient infrastructure to provide education to all (Mishra, 2000) about 17.7 million children of the country are still out of school ([www.thewire.in](http://www.thewire.in)). Female literacy is still low in comparison to male children both in rural and urban India as they are not educated when parents have to decide as to whom male or female child to be sent school under budgetary constraints. Lacking in awareness for the importance of education, the parents feel that education is of no use and does not equip the child for his future (Sanon, 1998). The short term economic benefits resulting from child labour are generally high as it generates an income which is higher than what is consumed in the family. Moreover, the child's earnings supplement something to the family and it saves the parents to bear expenditure on their education (Verma, 1993). Diverting the child labour from work means loss of income to the parents and an additional expenditure on education however small it may be. In this situation the child goes to work rather than to go to school for formal education. The effects of child labour are not only short term but have an impact on future of the children in the long run

Poverty acts as a disadvantage to school. Parents struggling for survival and fulfillment of their basic needs of food clothing and shelter are not in a position to fulfill their obligation to enroll their children at school. If at all, the children are sent to school, they feel handicapped at every step in the school as they fail to pay fee in time. They have no money to purchase books, uniform, shoes, school bags and other stationery items. Ultimately, these circumstances force them to lag behind the studies and open the door to dropping out the school.

When a child is working he/she does not find any time to go to school. Irregular attendance in the school results failure in studies and fear in the mind of the child which ultimately compels him to drop out the school. The children are also not encouraged to go to school as their parents know that it will reduce their income. The child who works instead of being in school loses opportunities to break out poverty and suffers severe and irreversible damage to physical and mental health. Kaul (1999) in his study established that child wage had a negative effect on probability that a child would work only and a positive effect on probability that a child would work and attend school. Kumar (2003) observed that child labour pulls the children out of the school and lack of proper educational opportunities push them in labour market. Once they enter the quagmire of childhood labour there is

no alternative and no avenues out of the swamp. Then the children are denied rights to education, adequate standard of living and opportunities of developing their personality, talents and mental and physical abilities (Sekar & Khurana, 2004). They are deprived of leisure, play and survival. Societies with a large number of working children produce more and more illiterate citizens who are devoid of skills needed for development which affects national development adversely. Thus the future of nation is also affected negatively.

#### **RESEARCH METHODOLOGY**

The study was carried out in Mandi Ahmedgarh, a small town in Sangrur district of Punjab. The town is famous for manufacturing an agricultural iron tool- sickle called *daatti* which is commonly used in harvesting especially wheat harvesting. A number of sickle making micro units to cater the domestic and local market are established in the town. Hundreds of children of nearby villages work in these units and are exploited for years by the manufacturers (Anonymous, 2002). A complete list of sickle making units was collected from the office of the municipal committee. Total 31 micro units making sickle were identified where child labour was being used. On personal visit to all the units, 102 children up to the age of 14 years were found working as labour in sickle making. All the children working in the sickle making units were made the respondents in the study. In order to achieve the stipulated objectives, a specially designed schedule was prepared, pre tested and used. Questions were framed in a simple and easy manner for the children to answer. Primary data were collected through direct interview method.

#### **RESULTS AND DISCUSSION**

##### **Schooling of Child Labour**

The results of the study revealed that all the working children engaged in agricultural tool making units were male. Thus no female child labour was engaged in sickle making. The possible reason for being the employment of only male child labour was that the work of sickle making was considered to be a tough work and was not suitable for girls to do. Table 1 shows the distribution of schooling of children engaged in sickle making units in Mandi Ahmedgarh in Punjab. The results of the study highlighted that only 13.73 per cent of the working children engaged in the sickle making units were found going to school, while 86.28 per cent of them were not going to school. Out of those who were not going to school, 48.30 per cent had never been enrolled in any school and 38.24 per cent were the drop outs. The age wise distribution of children working in sickle making units showed that about 50 per cent of the working children in the age group of 11-14 years were never enrolled to any school while about 37 per cent of them were the drop outs. Nearly, 41 per cent of the children in the age of 8-11 years were never been enrolled to school while 45.45 per cent of them were the drop outs. The only child (100 per cent) in the age group 5-8 years was also not

enrolled to school for formal education. In case of the working children, in the age group of 11-14 and 8-11 years about 14 per cent and 13.64 per cent respectively were going to school.

### Migration and Schooling

Migration stands in the way to have smooth opportunities in physical, intellectual growth and educational development of the child (Kulshreshtha, 1978; Mathur & Ghosh, 2002). Thousands of migrants from eastern states come to work in fields (Maninder & Goyal, 2015) and industries in Punjab with their families (Goyal, 2000). Children of the migrants join the work force to earn more so that the family may return to their roots at the earliest. In such circumstances, the children have to say goodbye to their school and adopt the work at a tender age of learning. The results of the study highlighted that out of 102 working children, 90 i.e. 88.24 per cent belonged to the families those were migrated from Bihar, Uttar Pradesh, Uttarakhand and Nepal while only 12 i.e. 11.76 per cent of them belonged to the families native of Punjab. It was also found (Table 2) that out of 102 working children, 90 i.e. 88.24 per cent belonged to the families migrated from Bihar, Uttar Pradesh, Uttarakhand and Nepal while only 12 i.e. 11.76 per cent of them belonged to the families native of Punjab. The results further revealed that out of the total 39 drop outs, 38 working children (97.44 per cent) were from migrated families while only one child (2.56 per cent) was the native of the state. In case of total 49 working children those had never enrolled to any school, 41 of them i.e.

83.67 per cent were migrated and eight children i.e. 16.33 per cent in were the native of Punjab sickle making.

### Educational Level of Child Labour

The study further revealed that 48 per cent of the children engaged in sickle making units in Mandi Ahmedgargh in Sangrur district in Punjab (Table 3) were illiterate, while remaining 51.96 per cent of them were literate. About 22.55 per cent had studied up to below primary level, while 19.611 per cent and 9.8 per cent of them had studied up to primary and middle level respectively. No child working in sickle making units was found having formal education up to matric level and above.

**Table 3: Distribution of educational level of child labour in sickle making units in Punjab**

Education level	No. of child labour	Percentage
Illiterate	49	48.04
Below Primary	23	22.55
Primary	20	19.61
Middle	10	9.80
Total	102	100.00

### Educational Level of the Parents

A large number of adult population in the country and the state of Punjab is illiterate. The parents being illiterate do not consider the role of education in removing children away from labour force. It was found the study that the father of majority of child labour (87.25 per cent) was illiterate (Table 4). About 6.88 per cent of the father of

**Table 1: Age wise distribution of schooling of child labour in sickle making units in Punjab**

Particulars	Age (Years)						Total	Percentage
	5-8		8-11		11-14			
	No. of child labour	Per cent age	No. of child labour	Percentage	No. of child labour	Percentage		
Going to school	-	-	3	13.64	11	13.92	14	13.73
i) Never enrolled	1	100	9	40.91	39	49.37	49	48.03
ii) Drop outs	-	-	10	45.45	29	36.71	39	38.24
Not going to school (i) + (ii)	1	100	19	86.36	68	86.08	88	86.27
Total	1	100	22	100	79	100	102	100

**Table 2: Distribution of migration and schooling of child labour in sickle making units in Punjab**

Particulars	Natives		Migrants		Total No. of child labour	Percentage
	No. of child labour	Percentage	No. of child labour	Percentage		
Going to school	3	25.00	11	12.22	14	13.73
i) Never enrolled	8	66.67	41	45.56	49	48.03
ii) Drop outs	1	8.33	38	42.22	39	38.24
Not going to school (i) + (ii)	9	75	79	87.78	88	86.27
Total	12	100	90	100	102	100

working children had studied up to primary standard while in case of 5 per cent of the child labour, the father had education up to middle standard. The educational status of mother of the working children was also analyzed. It was found that in case of majority of working children, mother i.e. 94 per cent was illiterate. Nearly four per cent of the children working in agricultural tool making had their mother studied below primary level whereas; two per cent of them had the education up to primary standard. None of them had studied up to middle level.

#### **Occupation of the Parents**

It is generally said that poverty breeds child labour. But the actual position seems otherwise. Child labour further aggravates it by creating unemployment among the adult labourers by remaining unskilled throughout life. Thus, child labour creates vicious circle of poverty, it becomes impossible to come out of it. The study revealed that (Table 5) the father of 50.98 per cent of the working children were unskilled labourer usually working on construction sites etc. The father of about 28.43 per cent of the child labour was involved in other activities like doing service at tea stalls, watchman, retail shops etc. Whereas, the father in case of about 10 per cent of the working children was involved in skilled labour activities such as working in factories and operating machines in various thread mills and paper milla doing in and around Malerkotla and Mandi Ahmedgarh. The father of about 10 per cent of the child labour was doing agriculture and father of about .98 per cent of the child worker in these units were found unemployed. Table 4 shows that the mother of 47.06 per cent of the child labour was

unemployed i.e. were housewives. The mother of 8.83 per cent of working children was unskilled labour like maid in houses, daily wage earners etc. Whereas, mothers of 30.39 per cent of child labour were involved in other activities like stitching of clothes, embroidery, mid day meal cook, sweeper etc. and mother of 7.84 per cent of working children were skilled labour as many of them were working in paper mills and thread mill nearby Malerkotla and Mandi Ahmedgarh.

#### **Educational and Non-educational Reasons for Child Labour**

As shown in the Table 6 the main reasons expressed by the children for being engaged in agricultural tool making units in mandi Ahmedgarh were poverty, lack of interest in studies, family support and untimely death of father. The major reason expressed by majority (54.90 per cent) of the child labour for joining the labour force was poverty. Those who had no interest in studies were either the drop outs or had never been enrolled to school and ultimately started doing the labour as 22.55 per cent of them had no interest in studies and started doing labour. Nearly 5.88 per cent of the working children reported that they joined work force as they gave up studies due to being failed in studies and 11.76 per cent of the respondents joined labour force directly to support their family economically. Whereas, only 3.93 per cent of the working children started doing work in an early age so as to learn. The study highlighted that non educational reasons such as poverty, death of the breadwinner in the family and the need to join employment to support the family financially were the reason in case of majority of the working children (66.74 per cent) while non

**Table 4: Distribution of educational level of parents of child labour in sickle making units in Punjab**

Education level	In case of Father		In case of Mother	
	No. of child labour	Percentage	No. of child labour	Percentage
Illiterate	89	87.25	96	94.12
Below Primary	5	4.91	4	3.92
Primary	7	6.86	2	1.96
Middle	1	0.98	-	-
Total	102	100	102	100

**Table 5: Occupation wise distribution of the parents of child labour in sickle making units in Punjab**

Occupation	In case of Father		In case of Mother	
	No. of child labour	Percentage	No. of child labour	Percentage
Unemployed	1	0.98	48	47.06
Agricultural labour	5	4.90	4	3.92
Unskilled labour	52	50.98	9	8.83
Skilled labour	10	9.80	8	7.84
Agriculture	5	4.90	6	5.88
Others	29	28.44	27	26.47
Total	102	100.00	102	100.00

**Table 6: Educational and non-educational reasons for joining work force of child labour in agricultural tool making units in Punjab**

Reasons	No. of child labour	Percentage
<b>Educational</b>		
No interest in studies	23	22.55
Failure in studies	6	5.88
To learn how to work	4	3.98
<b>Non Educational</b>		
Poverty	56	54.90
Death of father	1	0.93
To support family	12	11.76
Total	102	100.00

educational reasons such as no interest in studies, failure in studies and to learn the sickle making work were the reasons in case of rest of the children (32.41 per cent) for being the part of the working force.

**Contribution towards Family Income**

As discussed earlier, the main reason behind joining the work force of the child labour in agricultural tool making units was to supplement the family income due to poverty, absence of bread winner in the family or simply to supplement family income. The study further found that (Table 7) these children were contributing a negligible income to the family. Nearly, 12 per cent of the children were augmenting only less than ₹1500 to the family income while only two per cent of them contributed only above ₹3500 per month to the family. About 62 per cent of the children were contributing ₹1500-2500 per month to the family. The study concluded that the working children were augmenting a negligible amount of income to the family and were in the labour market at the cost of their education.

**Wish to Get Education in Future**

As discussed earlier, 88 working children (86.27 per cent) were either drop outs or had not enrolled to school, an effort was made to find out whether they aspire to go to school and get education in near future. On asking the child labour whether they would wish to get education if any opportunity provided to them in future (Table 8), 62.22 per cent of the children answered positively and were interested to attend non formal classes at night, while 37.78 per cent responded in negative.

**CONCLUSIONS**

Hundred per cent of the working children engaged in agricultural tool making units in Mandi Ahmedgarh were male as no female child labour was found in sickle making. The schooling rate was found very low. Only 13.73 per cent of the working children engaged in the sickle making units were going to school whereas, a majority i.e. 86.28 per cent of them were not going to school. Hundred per cent of the children in lower age group ( 5-8 years) and about 50 per cent of the working children in the higher age group (11-14 years) were never

**Table 7: Contribution of child labour engaged in agricultural tool making units in Punjab towards their family income**

₹ /per month		
Income contribution	No. of child labour	Percentage
Less than 1500	12	11.76
1500-2500	63	61.77
2500-3500	25	24.50
3500 and above	2	1.97
Total	102	100

**Table 8: Distribution of child labour in agriculture tool making units in Mandi Ahmedgarh in Punjab on the basis of their wish to get education in future**

Wish to get education	No. of child labour	Percentage
Yes	56	63.64
No	32	36.36
Total	88	100.00

enrolled to any school taken under the study. Migration of the child along with the family had a positive relation with the non schooling of the child labour as majority of the drop outs were from migrated families while only one child was the native of the state. Nearly half of the children engaged in sickle making units in Mandi Ahmedgarh in Sangrur district in Punjab were illiterate, while remaining and about one fourth of them had studied up to below primary level only. No child working in sickle making units was found having formal education up to matric level and above. Child labour's level of education or schooling was associated with the education of their parents also as in case of above ninety per cent of the child labour, father and mother were illiterate. The study also concluded that the parents of nearly half of the working children were either unskilled labourer or were unemployed. Though the major reason expressed by majority of the child labour for joining the labour force was poverty yet educational reasons such as no interest in studies, failure in studies and to learn while earn were the main factors responsible for their being out of school and in the labour market. On enquiring whether they would wish to get education if any opportunity provided to them in future more than sixty per cent of the working children answered positively and were interested to attend non formal classes at night. Since these children were found contributing a negligible amount of income to their families, the study suggests that the parents and the society as a whole should create such an environment that these children should not be denied their right to education.

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## **Doubling Farmers' Income by 2022: The Thaumaturgy yet to Befall**

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### **ABSTRACT**

*India has turned from rags to riches in food production only after turning the magic wand of green revolution. That decade may be remembered as a decade of this big miracle. But recent announcement of doubling farmers' income by 2022 may turn to be the most important magic yet to happen today. Doubling farmers' income is the most important issue to be taken when farmers' distress is the condition of every farmer. Recent government has set this big target but whether this target is achievable or not, time will give its result. Focusing only on income from cultivation for facilitating doubling of income will prove to be inadequate. With properly planned policy measures aiming at increasing net income of households this target will never be beating around the bush but will be the miracles of miracle.*

### **Key Words**

Doubling, farmer

### **JEL Codes**

D11, D60, E01, E21, E24

### **INTRODUCTION**

Addressing to farmers' distress, Honorable Prime Minister on the grounds of Bareilly gave a tough target and a challenge in itself for doubling farmers' income by 2022. Since Green Revolution the main focus remains increasing of production and productivity, but when farmers' income has to be addressed, then the thinking has to be from a different angle. Conversely, it can be said that the policies till date are usually farm centric not farmer centric. India has already achieved applaudable position in many agricultural commodities. But for raising farmers' income out of box thinking is required. This step has even received strong criticisms when the same was put forward by our Finance Minister in the Union Budget. Thereby it is evident that both Prime Minister and Finance Minister are targeting to double the farmers' income by 2022 which is 7 years from the current year. For achieving this objective some ground level plans has to be devised to augment farmers' income from not only agriculture but also its allied sectors. Thus looking into the debatable topic of the year, this paper has been designed specially to focus on the need for doubling farmers' income, changes that had taken so far and the prime areas whose upliftment will serve the purpose, thereby concluding to some extent

on that big question that whether it is achievable.

India's economy is driven by agriculture and allied activities therefore it is very important to look after the stakeholder's interests and its well being. As a source of livelihood, agriculture (including forestry and fishing) remains the backbone of Indian Economy. While its output share fell from 28.3 per cent in 1993-94 to 14.4 per cent in 2011-12, employment share declined from 64.8 per cent to 48.9 per cent over the same period. Therefore, almost half of the workforce in India still remains dependent on agriculture. Given the low share of this workforce in the GDP, on average, it earns much lower income poorer than its counterpart in industry and services. The most appropriate measure of farmers' well-being is the level of farm income. A notable contribution in the recent literature on farm incomes in India is by Chand *et al.* (2015) who suggests that growth in farm income after 2011-12 has plummeted to around one per cent, and this is an important reason for the sudden rise in agrarian distress in recent years. According to their study it was found that the per hectare farm income for the country as a whole from 2007-08 to 2008-09 was ₹33,267 per hectare, at 2004-05 prices. The income earned by 62 per cent of farmers in India who own less

than 0.80 hectares of cultivable land was lower than the poverty line during 2007-09. Therefore it is very important to address the reasons behind less capital formation in agriculture sector due to which farmers' income is very low. But the recent target that has special focuses on these areas that may solve this issue. Now time will only give answer to the question that whether the target turns out to be miracle of miracles or will be a failure.

#### Current STATUS of Indian Agriculture

Progress in agriculture has a direct effect on the fate of the largest proportion of the low income population in India. Every five year plans promises to bring improvement in miserable life of about 70 per cent lives of the country whose daily meals are dependent only on agriculture. When we turn the pages of the past, there were not much promising results seen in agriculture development. The per capita agricultural output has experienced a steady rise but the share of agriculture in the Gross Domestic Product (GDP) has fallen. Because of the rise in per capita agricultural production it has proved a slow medicine on easing pressure on meeting food and nutritional security of the country. But we should not forget that agricultural output follows cyclical path; high growth period succeeds the phase of low growth. This cyclical pattern has reflected itself in annual growth rates of approximately 3 per cent in the 10th Plan, 4 per cent in the 11<sup>th</sup> Plan and just 1.7 per cent during the first three years of the 12th Plan. This has led to severe negative shocks leading to severe farmers' distress.

Crop production in India is mainly dominated by cultivation of paddy in kharif and wheat in rabi season. 38 per cent of the gross cropped area is covered by these two crops. Cereals including coarse cereals occupy more than half of the total land under cultivation. Perusal of Table 1 shows that in the last 12 years between Triennium ending (TE) 2001-02 and TE 2013-14 there has been shift in area away from cereals. Area under cereal declined from 54 per cent to 51 per cent while that under pulses rose slightly

**Table 1: Distribution of gross cropped area across major crops**

Year	TE 2001-02	TE 2013-14
Rice	24.0	22.4
Wheat	14.2	15.6
Coarse cereals	15.9	13.1
Total cereals	54.0	50.9
Total pulses	11.3	12.5
Total food grains	65.3	63.6
Sugarcane	2.3	2.6
Condiment and spices	1.3	1.6
Total fruits	2.1	3.6
Total vegetables	3.3	4.7
Total oilseeds	12.4	13.9
Total fibres	5.2	6.6
Tobacco	0.2	0.2
Other crops	7.8	4.2
<b>GCA</b>	<b>100</b>	<b>100</b>

Source: Agricultural Statistics, 2015

from 11.3 to 12.5 per cent. Area share of fruits and vegetables witnessed significant increase but it still remains below 10 per cent. Thus it can be concluded that though the area under cereals decreased but there was not much increase in the area of pulses.

When International comparison was done outputs then the results were not much impressive. Though in second position yet India exhibits low yields in rice when compared to other countries. Rice yield in India is just 55 per cent of rice yield in China. Average yield of rice in India is much lower than other major rice producing countries like Bangladesh, Indonesia and Vietnam.

When we see results for wheat production then the situation is not much of much difference. Surprisingly India's yield in wheat is better as compared to other countries and it also surpasses United States in yield per hectare. China is the major producer of wheat that has far higher productivity than India. France, Germany and the

**Table 2: Country comparison of yields and shares in the world output in rice in 2014-15**

Country	Yield (kg per hectare)	Production (Per cent of world)	Country	Yield (kg per hectare)	Production (Per cent of world)
World	4548	100	Pakistan	4068	1.27
China	6775	27.9	Cambodia	3089	1.26
India	2390	19.03	USA	8349	1.23
Indonesia	5136	9.35	Korea, Republic	6988	0.8
Bangladesh	4421	6.84	Egypt	9530	0.8
Viet Nam	5631	5.91	Nepal	3312	0.69
Thailand	3051	5.08	Nigeria	1800	0.65
Myanmar	3445	3.8	Madagascar	2938	0.62
Philippines	3845	2.44	Sri Lanka	3885	0.52
Brazil	4786	1.56	Iran	5000	0.33
Japan	6739	1.44	Russian Federation	490	0.14

Source: Agricultural Statistics, 2015

**Table 3: Country comparison of yields and shares in the world output in wheat in 2014-15**

Country	Yield (kg/ha)	Production (Per cent of world)	Country	Yield (kg/ha)	Production (Per cent of world)
World	3090	100	Iran	1971	2.06
China	4987	18.02	UK	6657	1.97
India	2872	10.75	Kazakhstan	683	1.47
USA	3115	9.19	Egypt	6582	1.31
France	7599	6	Poland	4144	1.28
Russian Fed.	1773	5.62	Argentina	2715	1.22
Australia	2215	4.45	Italy	4132	1.16
Canada	2865	4.05	Romania	2659	0.79
Pakistan	2709	3.5	Spain	2644	0.69
Germany	7328	3.34	Syrian Rep.	2252	0.54
Ukraine	2800	2.35	Bangladesh	2779	0.15

Source: *Agricultural Statistics, 2015*

United Kingdom exhibit super-high productivity in wheat but their contributions to the world output are significantly smaller than those of India and China.

These were all about India's rank in some of the agricultural commodities by now. In the next section we will discuss the changes that had taken so far in farmers' income. So that we can estimate whether doubling of income is possible.

#### Variations in Farmers' Income

Analysis of possibility of doubling farmers' income is very important to achieve the target. Since over time the number of farmers, number of holdings, number of farm family members engaged in agriculture (cultivators), and number of labourers has changed. Therefore, analysis of income per cultivator, per farm holding and per labourer gives idea about the level and increase in income of farmers and agricultural labourers. The Table 4 also reports income at current prices and on a per hectare basis. Between 1983-84 and 2011-12, the farm income per cultivator deflated by CPIAL (base year 2004-05) rose 2.7 times, from ₹16,103 to Rs 42,781. Farm income per holding doubled and per hectare of net sown area trebled. Wage earning per labourer in the same period rose 3.2 times.

Therefore when the same period is taken into consideration 2012-16, there is possibility of doubling farmers' income by then.

In Table 5 when different classes of farmers are taken into consideration it is also evident from the study that doubling income has been possible among those households with over 10 hectares of land. In fact, any household with at least one hectare of land saw their income from cultivation and total income increase at least by 1.5 times. The noticeable point here is the role played by farm income from animals. The ratio was found to be highest in this sector. Livestock sector has that untapped potential whose improvement can help us achieving the target.

Talking about the recent available estimates it was

**Table 4: Real farm income**

Year	Per cultivator	Per hectare net sown area	Per holding	Wage earning per labourer
1983-84	16103	14798	22603	5513
1987-88	17030	16770	22298	6630
1993-94	21110	21345	27147	8168
1999-2000	26875	26737	31325	9931
2004-05	26146	30755	34103	10043
2011-12	42781	44176	44688	17662

Source: *Chand et al.(2015)*

found that the average monthly income per agricultural household was estimated as ₹6426. Nearly 60 per cent of the average monthly income per agricultural household was estimated to have generated from farm business (cultivation and farming of animals). About 32 percent of the average monthly income per agricultural household was contributed by income from wage/salary employment.

Agricultural households in the lower size classes of land possessed were mostly dependent on wage/salary employment than farm business (cultivation and farming of animals) for their income. For the households belonging to the lowest size class, farming of animals fetched more income than cultivation. Percentage share of income from cultivation in the average monthly income increased with increase in land possession from a little less than 1 per cent in the lowest size class of land possessed to about 86 per cent in the highest size class of land possessed. Share of income from non-farm business in the average monthly income decreased with increase in land size except for land size class 2. Thus when doubling of income comes to thought then special focus has to be on lowest class and also on income from allied sectors of agriculture.

#### Issues Confronting to Farmers' Income

##### Special focus on small famers

Majority of farm households in India belong to small

**Table 5: Ratio of average monthly income from different sources in 2013 to the average monthly income from different sources in 2003**

Size class of land possessed	Income from wages	Net income from cultivation	Net income from farming of animals	Net income from non-farm business	Total income
<0.01	1.01	0.34	3.40	0.63	1.13
0.01-0.40	1.07	1.09	2.78	0.67	1.10
0.41-1.00	1.26	1.40	2.61	1.08	1.38
1.01-2.00	1.23	1.50	3.31	1.61	1.52
2.01-4.00	1.26	1.54	5.39	1.23	1.59
4.01-10.00	1.81	1.76	7.88	1.33	1.85
>10.00	1.23	2.06	3.58	1.32	2.02
All classes	1.22	1.32	3.21	1.00	1.34

Source: Chandrasekhar, (2015)

farmer categories and special attention has to be given to these categories for achieving our set target. It is evident from the above tables that if income of farmers has to be doubled then income from farming of animals can prove to be a viable option. Small farms matter because they exist in huge numbers, and cast their shadow over a whole range of development issues. The efficiency of smaller farms has been demonstrated by an impressive body of empirical studies showing an inverse relationship between farm size and land productivity (e.g. see Eastwood, Lipton and Newell, 2010). A large number of studies during the 1960s and 1970s provided convincing evidence that crop productivity per unit of land declined with an increase in farm size (Sen, 1962, 1964; Mazumdar, 1965; Khusro, 1968; Hanumantha Rao, 1966; Saini, 1971; Bardhan, 1973; Berry, 1972) which provided strong support for land reforms, land ceiling and various other policies to support smallholders on ground of efficiency and growth.

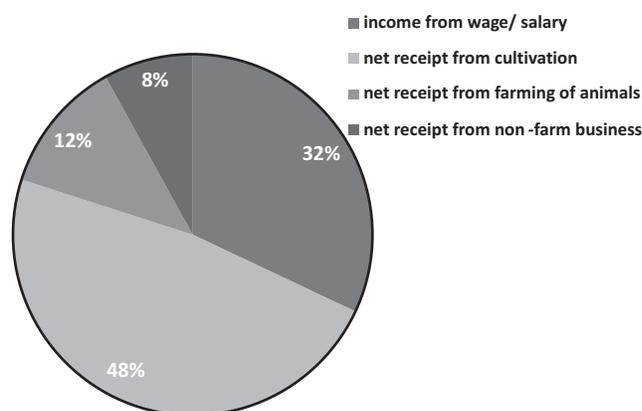
#### Agrarian distress

Analysis of the status of a farmers' income in relation to the incomes of other sections of society is an important issue confronting to farmers' income. It is often felt that disparity between farm income and non-farm income is rising (Chand, 2009) and that those who work outside agriculture are progressing much faster than those who work in it. These factors are considered the reasons for rising distress among farmers in the country.

It is concluded from Table 7 that in the two decades after 1983–84, the growth in income of farmers and agricultural labourer could not keep pace with the growth in income earned by non-agriculture workers. However, recent years have seen some narrowing of gap in the income earned by those who are engaged in agricultural activities and those who are engaged in non-agricultural occupations.

#### Remunerative prices to famers

This issue has two aspects, one relating to the Minimum Support Price (MSP) and the other relating to



**Figure 1: Percentage distribution of average monthly income per agricultural household by sources**

the farmers' share in the price paid by the final consumer. Taking the MSP first, it effectively applies to a specified set of commodities, predominantly rice, wheat and cotton, and is available only in a subset of producer states. In the states in which no procurement is done by the public agencies at the MSP, farmers lack the guarantee offered by the MSP (Chand, 2003; Anonymous, 2007; Anonymous, 2015). Moreover, subsidized sales of cereals under the public distribution system (PDS) divert part of the demand thereby artificially lowering the price at which they must sell their produce. Likewise, for commodities such as fruits and vegetables, which are not subject to any procurement by official agencies, sometimes the market price can be excessively low due to perishability and localized nature of markets for them. The second aspect of the price received by the farmer concerns the small fraction of the price paid by the final consumer that the farmer receives in the marketplace. The APMC market yards are subject to vast technical as well as marketing inefficiencies that undermine the prices that farmers receive (Chand, 2012). Only a genuine implementation of the model APMC Act of 2003, which introduces all-

**Table 6: Average monthly income from different sources, monthly consumption expenditure per agricultural household in 2013 for each size-class of land possessed**

Size-class of land possessed	Income from wages	Net receipt from cultivation	Net receipt from farming of animals	Net receipt from non-farm business	Total income	Consumption
<0.01	3019	31	1223	469	4742	5139
0.01-0.40	2557	712	645	482	4396	5402
0.41-1.00	2072	2177	645	477	5371	5979
1.01-2.00	1744	4237	825	599	7405	6430
2.01-4.00	1681	7433	1180	556	10849	7798
4.01-10.00	2067	15547	1501	880	19995	10115
>10.00	1311	35713	2616	1771	41412	14445
All classes	2146	3194	784	528	6653	6229

Source: Chandrasekhar (2015)

**Table 7: Disparities in agriculture and non-agriculture income**

Year	Farm income per cultivator (F)	Wage earning per agricultural labourer (L)	Income per non-agricultural worker (N)	Ratio L:F	Ratio N:F
1983-84	4286	1467	12786	0.34	2.98
1987-88	5653	2201	18036	0.39	3.19
1993-94	12365	4784	37763	0.39	3.05
1999-2000	24188	8938	78565	0.37	4.08
2004-05	26146	10043	106688	0.38	4.08
2011-12	78264	32311	246514	0.41	3.15

Source: Chand et al., 2015

around marketing reform, can ensure that the farmer gets her fair share of the price paid by the final consumer (Gulati and Ganguly, 2010).

#### Uncertainty of agricultural production

Farmers are frequently affected by natural disasters such as droughts, floods, cyclones, storms, landslides, hails and earthquakes. Because most farmers lead subsistence existence, such disasters can lead to extreme distress and hardship. Though some crop insurance schemes have been tried in the past, they have not worked effectively (Chand, 2005; Raju and Chand, 2007). One critical problem is that these programs predominantly cover only farmers with outstanding bank loans. Because the poorest farmers are unable to access the banking system in the first place, they are rarely covered by the insurance. There is acute need to rectify this situation by providing for at least minimum quick relief to marginal and small farmers in case of natural calamities that destroy a large proportion of the crop.

#### Untapped potential of the Eastern region

We need to pay special attention to the problems of farmers in eastern states. Given fertile land and abundant water resources, these states have a high potential in agriculture. Yet, their productivity in various crops lags behind the national average. Despite favourable climatic conditions and water availability crop intensity in the

region is low. Therefore, concerted effort is required to bring the Green Revolution to these states (Gulati et al., 2012).

#### CONCLUSIONS

Though doubling farmers' income is a debatable target but yet it is not impossible. Government has to take tough steps to achieve this target. No doubt PM's five point strategies can solve this issue to some extent. Moreover attempt should be to increase income in real terms. Focusing only on income from cultivation for facilitating doubling of income will prove to be inadequate. Policy measures aimed at increasing net income of households from animal farming will be the key driver of incomes in agricultural households. There is also need to improve our understanding of what constrains income growth from non-farm business at the household level. Doubling farmers' income needs funds at institutional level as well as at enterprise level, for which a robust institutional credit flow mechanism is a must. There is need to create a healthy credit environment by enhancing access to credit through technology in equitable manner. Our resource-scarce farming community such as small and marginal farmers, tenant farmers, share croppers, etc, and farmers in east, centre and northeast regions deserve special attention. With a good strategy, well designed programmes, adequate resources and good governance in

implementation, this target is achievable.

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## **Identifying Different Potential Areas for Enhancing Farm Income**

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### **ABSTRACT**

*Agriculture has become more input intensive resulting in yield levels crossing their initial potentials, further slowing down the productivity growth. Due to input prices rising faster than output prices, economic profits have squeezed. In addition to this, the social expenditure has increased and education as well as medical care has become very expensive. Consequently, small farm holders are under severe economic stress. The present study entitled "Identifying different potential areas for enhancing farm income" is a review paper which reviews different studies on potential areas for enhancing farm income. This paper is an attempt to assess different potential areas viz. land reforms, soil health, quality seeds, irrigation, storage, value addition of farm produce, post-harvest management, crop insurance and crop diversification, so that ways to be found to help farmers in increasing farm productivity and thus improving economic conditions. The study concludes that government is coming up with new reforms and policies in some areas. There are other areas also where government needs to come out with better solutions. At the same time, farmers should also be made aware of the reforms and policies made for them. Extension system needs to be made strong to achieve the vision of doubling farm income by 2020.*

### **Keywords**

Farmers, farm income, potential areas

### **JEL Codes**

A11, G18, O13, Q01, Q13

### **INTRODUCTION**

Agriculture is regarded as the backbone of India's economy. It plays a vital role in economic development by providing livelihood options for more than 72 per cent of rural population. Indian economy is considered as an agricultural economy. Agricultural and allied sectors contribute fourteen percent share in Gross Domestic Product (GDP) of the country. India stands at third position in terms of cereals production and first in terms of pulse production in the world (Anonymous, 2014). All these positions could be achieved after green revolution. The green revolution gave emphasis on increased production and productivity but rarely any focus was on enhancing the farmers' income. Many a scheme in agriculture, during the five-year planning cycles, generally aimed at enhancing production and productivity which would indirectly enhance farmers' incomes. Our policies were usually farm-centric and not farmer-centric. This is one of the reasons why there is farmers' distress despite the fact our country has achieved commendable position in food production. We need to think beyond food

security and give back to our farmers a sense of income security. There is need to reorient interventions in the farm and non-farm sectors to double the income of farmers. Government needs to proactively address the situation and make more long term farmers centric policies related to irrigation, farm diversification, farm profitability and community support programs so as to socially and economically empower farmers. Prime Minister Narendra Modi, while addressing a farmers' rally at Bareilly in Uttar Pradesh on February 28, 2016 expressed the government's desire to double farmers' income by 2022.

Green revolution which started in 1967-68, led to phenomenal increase in agricultural productivity and production, which brought economic prosperity in farming. But over the years, agriculture became more input intensive, yield levels almost reached the initial potentials and further productivity growth slowed. Under the environment of input prices rising faster than output prices, economic profits squeezed. Due to intensive use of fertilizers, the fertility of the soil affected which resulted

into lower productivity and thus lower farmers' income. In addition, social expenditure increased as well as education and medical care became very expensive. Consequently, small farm holders are under severe economic stress. In rural areas, land is largely the major income generating asset and thus, family income is directly related to the size of land one cultivates or owns.

The ground reality is that majority of the farmers in India own as little as two acres of land (Table 1). Cultivation on such small area is not economically feasible. Such small farmers have become vulnerable. In many cases, the farmers are not even the owners of the land, which makes profitable cultivation impossible because significant portion of the earnings go towards the payment of lease for the land (Anonymous 2016)

This study is an attempt to identify **different potential areas for enhancing farm income**. The design for the study is descriptive research. The existing literatures available in different sources (papers in scientific journals, books, evaluation reports, scheme brochures, annual reports, etc.) in India are mapped for this purpose. The focus of the review is to identify potential areas for doubling Indian farmer's income by 2022.

The critical analysis of the research work done in India indicated the following potential areas where reforms are required to enable farmers to increase their income:

**Land reforms**

**With increasing population, land fragmentation is unavoidable. This land fragmentation leads to lower productivity.** However, a new approach to cultivation and management may sustain productivity. Kapur (2016) discussed that at present; tenant farmers are cultivating under informal arrangements and refrain from making any capital investment. State government should devise a mechanism for consolidation of land from willing sellers into economically viable land units and setting up of farmers' cooperatives. Certainty of price, time period and other attendant conditions under formal leasing agreement can give assurance to both land owner and lessee. He further discussed that Government may also consider enabling other land aggregating measures such as long term leases for selected crops and help promote long-term investments in technology. Opening of Public Private Partnership (PPP) model can be another initiative to enable multiple farmers, multiple aggregators and

marketers to work together to enhance farmer's income. On the other hand, Besley & Burgess (2000) discovered something different regarding land reform legislation. They used state-level data for the sixteen major Indian states from 1958 to 1992 and exploited the variation across states and over time in land reform legislation to identify the effect of land reform on productivity and poverty. They found that abolition of intermediaries had a negative effect on poverty, but no effect on productivity. Imposing a ceiling on landholdings does not seem to have had much effect on either poverty or productivity, while land consolidation had a positive effect on productivity without having any effect on poverty. The authors further revealed that land reforms did not have much effect on the distribution of land and seemed to have operated mainly through altering the contractual relations in agriculture. Thus it can be concluded that land consolidation can help farmers to enhance the productivity and thereby increase their income.

**Use of quality seeds:**

Seed is the true carrier of technology. In India, three sets of institutions produce seeds: research institutions and agricultural universities; public sector seed producing corporations; and private sector firms including multinationals. The last decade has seen two main developments in seed market. One, production of quality seed has increased at a rapid rate after 2005-06 and two, public sector has begun to effectively compete with the private sector. Beginning with 2001-02, there has been a distinct change in the role of public sector in the development of hybrid in all crops. In order to raise productivity, several steps need to be taken to improve the quality of seeds used by farmers: community Seed Banks can reduce dependence of farmers on market for seeds. It will not only give proper storage facility to enhance satisfactory germination but also save the seeds from damage. Regulatory measures for quality seed production have to be tightened so as to discourage the sales of spurious seeds to farmers. (Anonymous, 2015a)

**Prudent use of fertilizers / soil health**

The intensive use of fertilizers has affected the soil health which has affected the crop productivity. There is need for balanced and integrated use of nutrients based on soil test with thrust on application of deficient secondary and micro-nutrients. Government of India **launched Soil Health Card Scheme** in February 2015. Under the scheme, the government plans to issue soil cards to

**Table 1: Number of operational holdings (2010-11) in India**

Category	Number (000)	Percentage	Area (000ha)	Percentage
Marginal (less than 1ha)	92826	67.00	35908	22.30
Small (1-2 ha)	24779	17.90	35244	22.10
Semi-medium (2-4ha)	13896	10.00	37705	23.70
Medium (4-10 ha)	5877	4.20	33828	21.20
Large (10 ha and above)	973	0.70	16907	10.60
Total	138348		159592	

farmers which will carry crop-wise recommendations of nutrients and fertilizers required for the individual farms to help farmers to improve productivity through judicious use of inputs. Fourteen crore Soil Health Cards are to be distributed by Government of India in about 6 lakhs villages (Anonymous 2015b). Similarly, fertilizer application methods, their quantity and doses for different nutrients need to be followed to increase their use efficiency. There is need to provide crop specific solutions consisting of specialty fertilizers along with value added services. Implementation of Nutrient Based Subsidy for P&K fertilizers was a positive step by the Government. 100 per cent *Neem* coated urea will be instrumental in controlling deterioration of soil fertility in the longer run. *Swachh Bharat* (Clean India) mission of Government to extend subsidy to City Compost for usage are steps in the right direction, however, quality issues prevail. Approximately 62 MT of organic waste is expected to be converted into compost for use in agriculture with total nitrogen content of about 5 lakh tonnes (Kapur, 2016).

#### Proper selection of irrigation method

In order to improve farm productivity, the water use efficiency needs to be increased. For this purpose, the right method of irrigation is very important. There are several methods which can help in increasing water use efficiency. Kaushal *et al.* (2008) reported that Laser land leveler can save up to 30 per cent irrigation water. A study of cotton farmers in Tajikistan (Abdullaev *et al.*, 2007) revealed that the average annual net income from cotton farming in the laser leveled field was 22 per cent higher than the control field, and the gross margin from the laser leveled field was on average 92 per cent higher than the control field.

Furrow irrigation method needs to be adopted in wide-row crops like cotton, sunflower, maize and vegetable crops that save up to 20 percent of irrigation water. Improved irrigation systems like sprinkler and drip have the potential to increase irrigation water use efficiency as high as 75-90 per cent. Methods of irrigation can aid in bringing more area under irrigation leading to higher yields because of the efficient and timely use of water by the crop (Anonymous, 2013). Researchers have documented the increase in the water use efficiency through micro irrigation to an extent of 40 to 80 per cent apart from increased productivity. These methods can be adopted in areas having excessively coarse textured as well as slowly permeable soils, undulating lands having high cost of levelling, and in areas of high water table more so with poor quality water. The Punjab Government is providing 50 percent subsidy for encouraging large scale adoption of sprinkler and drip by the famers through the Department of Soil and Water Conservation.

#### Post-harvest loss management

The postharvest sector includes all points in the value chain from production in the field to the food being placed on a plate for consumption. Postharvest activities include: harvesting, handling, storage, processing, packaging,

transportation and marketing.

Significant amounts of the food produced in developing countries are lost (15 -50 per cent) after harvest. The causes of post-harvest losses are manifold. These include: harvesting at an incorrect stage of produce maturity, excessive exposure to rain, drought or extremes of temperature, contamination by micro-organisms and physical damage that reduces the value of the product.

Food losses contribute to high food prices by removing part of the supply from the market. There are a wide range of postharvest technologies that can be adopted to improve losses throughout the process. Recommended technologies vary depending on the type of loss experienced and include: Using liners for existing packages, sorting produce by quality, providing shade, using tables, using dry ice for insect control, low energy cold storage, monitoring produce temperature, improved transportation, low-cost food processing, solar drying and curing. Thus skill training in using these technologies will help farmers in reducing post-harvest losses and thereby increasing their income.

#### Improvement in storage and warehousing facilities

Another problem faced by farmers is storing their agricultural produce safely. A warehouse is a commercial building not only to store goods for safekeeping, but also minimize wastage and costs. The Parliament passed the Warehousing (Development and Regulation) Act, 2007, which came into force on October 25, 2010 created the Warehousing Development and Regulatory Authority, a central regulator for Negotiable Warehouse Receipts (Anonymous, 2015c).

Warehousing sector is being controlled by Government and PSUs such as the Food Corporation of India, Central Warehousing Corporation (CWC) and State Warehousing Corporation. The capacity of the organized warehouses, controlled by PSUs, cooperatives and private sector, is 117.52 million tons, of which the private sector has only 18.97 million tons, the details of the warehousing capacity is given in Table 2.

Warehousing plays a significant role in encouraging agriculture marketing, financing, rural banking and also by ensuring food security in the country. It enhances the effortless marketing during harvest season and to

**Table2: Status of warehousing capacity in India (2014)**

Name of the organization/sector	Storage capacity (Mt)
Food Corporation of India (FCI)	38.34
Central Warehousing Corporation (CWC)	10.30
State Warehousing Corporation (SWCs) and State agencies	34.84
Cooperation sector	15.07
Private sector	18.97
Total	117.52

*Anonymous 2014*

maintain continuous source of agricultural commodities during off season. Hence, it avoids the distress and apart from tackling the problems such as scarcity and glut which are the common problems in maximum agricultural markets. The findings of Richard & Panos (1996) revealed that warehouse receipts act as tool which permits farmers to extend the sales period of fairly perishable products even after harvesting season while findings of Mahanta (2012) stated that warehouse receipts offers confidence among depositors and act as negotiable instrument which can secure the stored commodities with definite quality and quantity.

#### **Better market price realization**

Market plays a crucial role in the production process. The agricultural markets in developing countries are not perfect. Therefore, the agricultural price policy was envisioned in the early sixties to protect the producers as well as consumers from the vagaries of market and buyers' monopolies and cartels. Therefore, the institutions of Agricultural Prices Commission (APC), later designated as Commission for Agricultural Costs and Prices (CACP) and Food Corporation of India (FCI) were set up to announce minimum support prices for agricultural commodities and to buy them as the 'buyer of last resort' at the minimum support prices announced by the government and the recommendations of the CACP. It is often argued that minimum support price policy is effective for only two crops, i.e., for wheat and paddy. A study conducted by Sharma *et al* (2016) reported that half of the respondents suggested to fix minimum support price for other crops also for promoting crop diversification.

#### **Branding of farm products**

A brand is the combination of a name, words, symbol, or design that identifies the product and a company and differentiates it from the competition (Giddens, 2015). Branding serves as a way for consumers to quickly and easily identify one product from another and to associate them with quality attributes related to the brand name.

For most of the agricultural products, there is no remarkable perceived difference in the eyes of the consumers. The fact is that a market or industry remains commodity driven if products fail to differentiate in the eyes of the consumer. Thus, we can say, for a consumer, all varieties of rice or wheat are perceived to be the same and therefore should command almost similar price. However, as commodity markets become more competitive and over-saturated because of oversupply in domestic market and inflow of imported produce, prices are depressed and more competition among the producers and sellers increases. This has led to an increasing demand for branding of agricultural products. The essence of successful branding is when the brand delivers consistently, a clearly defined, appealing offering that sets it apart from its competitors (Singh, 2016). Branding the farm products is another way of increasing farmers' income.

#### **Value addition / Food processing**

**Value-added agriculture** is the other way to boost the farmer's income by boosting the value of primary agricultural commodities. Value-added agriculture may also refer to increasing the economic value of a commodity through particular production processes, e.g., organic produce, or through regionally branded products that increase consumer appeal and willingness to pay a premium over similar but undifferentiated products. In general, adding value is the process of changing or transforming a product from its original state to a more valuable state such as processing wheat into flour, processing chili and turmeric in ground spices, preservation of fruits and vegetables in the form of pickle, murabba, jam etc. It is important to identify the value-added activities that will support the necessary investment in research, processing and marketing. Coltrain *et al.* (2000) argued that agricultural value-added initiatives have been identified as a means to help producers absorb the shocks brought about by globalization. More R&D is required in this direction and farmers need to be motivated to take up these activities.

Bhavani *et al.* (2006) analyzed that the Indian food processing industry is benefited from liberal trade and industrial policies, making the food industry one of the fastest growing sectors in post-reform India. The food processing sector constitutes 9 to 10 per cent of GDP in Agriculture sector (₹638,301 crores) or Manufacturing sector (₹774162) in 2010-11. The growth rate of the sector went up to 13.7 per cent in 2008-09 from 6.7 per cent in 2004-05 surpassing the growth rates in both agricultural and manufacturing sectors (Sharma and Bathla, 2012). Government is taking various initiatives to promote food processing so that the farmer can be benefitted more and could be able to increase his income.

#### **Crop insurance**

Initiatives like individual crop insurance for farmers, instead of the current block-based insurance can help improving farmer's income and help him to overcome vagaries of nature. The *Pradhan Mantri Fasal Bima Yojana* (Prime Minister's Crop Insurance Scheme) was launched by Prime Minister of India Narendra Modi on 18 February 2016. It envisages a uniform premium of only 2 per cent to be paid by farmers for *Kharif* crops, and 1.5 per cent for *Rabi* crops. The premium for annual commercial and horticultural crops will be 5 per cent. Prime Minister Narendra Modi has asked for integration. This scheme is dedicated to bring in more than 50 per cent of the farmers under its wing within the next 2–3 years. Around 25 per cent of the claims will be sent to the farmer's direct account. This means that there will be no cap on coverage as well as on the reduction in the insured sum. Farmers should be motivated to enroll in crop insurance schemes.

#### **Availability of credit**

Easy credit at low rates is essential for the farmers. Making institutional finance available to every farmer is another important solution to save the farmers from debt

traps of money lenders. Where institutional finance is available, it should be made easily accessible to the poorest farmers. This calls for removing of elaborate formalities and procedures for obtaining the loans. Effective monitoring of the disbursed funds is also required because in many cases, the poor farmer is used as a front-end while in fact the benefit of the loan is availed by a bigger land owner. In addition, monitoring is also needed to ensure that the farmers are using the funds for the right purposes. The recent decision of Reserve Bank of India to exempt farmers from submitting "no due" certificate (NDC) for obtaining loans up to ₹50,000 from banks is a step in right direction.

#### **Contract farming**

Contract farming is another way of increasing income. It is an arrangement for the production and marketing of agricultural produce in which farmers and firms (mainly agro-processing and/or exporting) enter into advance contracts to purchase produce of predetermined quality and quantity at a predetermined price and time, often with the provision of certain services such as inputs and technical assistance to farmers (Sharma, 2016). In Punjab, the issue of diversification has acquired much significance in recent times, following the increasing repercussions of wheat-paddy dominance. The case study conducted by Sharma (2016) compared the economics of contract versus non-contract farming of potato and basmati paddy in Punjab, and found that on average, contract farmers have better farm returns and resource use efficiency than non-contract farmers. Kaur (2014) in her study reported that the farmers who adopted contract farming in different years have increased their area under contract with PEPSICO Plant.

#### **Diversification of agriculture**

**Diversification of agriculture in the First Green Revolution areas** such as Punjab, Haryana and Western U.P. seems need of the hour. To promote diversification on ecological principles, will require making monetary equivalence (profit margin) between the replaced crop/commodity and enterprise with the ones planned to be introduced. Crops like maize, soybean, pulses, oilseeds, fruits and vegetables have the potential to replace rice and wheat in this area. Upward push in MSP in favour of proposed diversification crops will be a practical option to achieve this objective. Thiagu (2014) reported that diversification seems to increase both returns per hectare and profitability. He concluded that in *Kharif*, returns per ha of farm households cultivating 2, 3, 4 and 5 crops were 130, 146, 120, and 146 per cent of that of households practicing mono-cropping. The profitability in *Kharif* for farm households cultivating 2, 3, 4 and 5 crops were 110, 119, 110, and 119 and of that of farm households practicing mono-cropping. In *Rabi*, the returns per ha for farm households cultivating 2, 3, 4 and 5 crops were 110, 110, 105, and 130 per cent of that of farm households practicing mono-cropping. The profitability in *Rabi* for farm households cultivating 2, 3, 4 and 5 crops were 107, 108, 103, and 102 per cent of that of farm

households practicing mono-cropping.

#### **CONCLUSIONS**

India needs to start a revolution which can take its farmers fast forward in time, creating them economically viable and growth drivers of our economy. Government is taking various initiatives in improving farm facilities but farmers need to be aware about these initiatives and are required to be skilled in using new technologies. Here the role of scientific community for better R&D as well as the role of extension scientists to take these technologies to the end users is very important. With the advent of information communication technologies, now reaching farmers at the distant places becomes easier. Thus with the help of ICT, extension scientist should work towards bringing prosperity in the life of farming community. A mechanism has to be developed for harnessing the power of our farmers and opening up new horizons for them with the promise of a better tomorrow. Various strategies like quality seeds, soil health, warehousing, branding etc. can trigger a virtuous cycle of higher productivity, higher incomes, enlarged capacity for farmer risk management, leading to higher order investments. This will lead to higher family living standards, thriving communities and more sustainable farming practices.

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## **Improving Farmers' Income by Futures Trading: A Case Study of Chickpea in India**

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### **ABSTRACT**

*India is largest producer (25 per cent), consumer (27 per cent) and importer (14 per cent) of pulses in the world. Gram, tur, moong and urd are major pulses grown in India among which, gram (chana/chickpea) contributes maximum share (43.84 per cent) in the total pulse production in 2015-16. From past few years, volatility in the prices of pulses is most concerning issue in the agricultural scenario of India. Increased price volatility will results into variations in farm income. Futures trading, in this context emerged as a boom as it not only smooth the volatility and mitigate the price risks but also discovers the prices of commodity so that farmers can plan their activities in order to improve their income. Present study is conducted to examine the relationship between spot and futures prices of chickpea in India. The data on spot and futures market prices were collected from the NCDEX website for the period January, 2005 to December, 2015. Johansen cointegration test was employed to assess the long run associationship between two price series. The direction of relationship was examined by using Granger causality test. Vector Error Correction Mechanism (VECM) was employed to model the short run relationship. The cointegration results confirm the existence of long-run relationship between the two price series. The study concluded that there is a causal relationship form futures to spot, thus futures trading fuels the farmer to take the appropriate decisions which in turn will improve their income.*

### **Keywords**

Future trading, Granger causality, Johansen cointegration test, price discovery, VECM

### **JEL Codes**

C82, C87, G13, Q11, Q13, Q18

### **INTRODUCTION**

Pulses are rich in proteins, high in fiber content, provide ample quantity of vitamins and minerals and found to be main source of protein to vegetarian people of India. Keeping in view large benefits of pulses for human health, the United Nations has proclaimed 2016 as the International Year of Pulses. Pulses in India have become the most curious case since last few years. Despite of being the largest producer of pulses in the world, it cannot meet the total consumption requirement of the country. Being the largest consumer of pulses, it consumes around 23 million tons of pulses whereas, its production has stagnated at around 18-19 million tons for several years now. The shortfall between production and consumption is made up by imports, mainly from Canada, Myanmar and some African countries which, again make it the largest importer of world.

Pulses in India attract the attention of all the

stakeholders of economy, when inflation crosses the tolerance limit. The last few years have seen frequent and regular acceleration in pulse prices. In the last decade 2004-05 to 2014-15, while overall WPI inflation rate fell to 6.3 per cent, pulses inflation has been much higher at 9.4 per cent average. Data for the last decade shows a clear pattern of spike in pulses inflation every third year. In spite of this increase in prices, farmer's share in consumer rupee haven't increases. It's not only the skyrocketed rates of pulses like in 2015 where pulse prices increased by 100 per cent, but also the fall in prices in 2016, like in the Maharashtra which have contributed to the instable farmers' income.

Price volatility is one of the others drawback of agricultural commodities in India. But, this price volatility is necessary for futures market to be an effective instrument. Futures are not an instrument that can reduce price volatility but are the best financial tool to manage its

negative consequences. Futures market perform two key functions which plays a crucial role in increasing farmers' income. Firstly, futures as a risk management tool, where farmers can lock in certain harvest price for their agricultural production, thus excluding the possibility that their selling price will fall in the future. This process is known as hedging. Secondly, as an instrument for price discovery, which allow farmers to estimate the future spot prices for their agricultural products. As per these price signals farmers' can plan those cropping pattern, time of sell and other activities which can assure maximum profit to them.

Futures trading in India was started with the establishment of first commodity exchange in 1875 with the Bombay Cotton Trade Association. At present there are 21 regional exchange markets and 19 national exchanges markets in our country. Multi Commodity Exchange (MCX) Mumbai, National Commodity and Derivatives Exchange (NCDEX) Mumbai, National Multi-Commodity Exchange (NMCX) Ahmadabad, are the prime regulators at the country level. Currently these exchange markets are carrying out futures trading activities in as many as 146 commodity items (Kumari, 2014). In September 2013, the regulatory body of commodity markets, Forward Market Commission(FMC)has been brought under the control of Ministry of Finance. In September 2015 the FMC was merged with Securities and Exchange Board of India (SEBI) for better regulation. NCDEX holds a major share in the agricultural commodity in India. Currently it facilitates trading of thirty six commodities which includes most of the agricultural commodities. About seventy per cent of the trading volumes in NCDEX have been achieved by the top four commodities namely Refined Soyabean oil, Soyabean, castor Seed and Chana (Shakeel *et al.*, 2014).

Among pulses, chickpea is the most dominant pulse having a share of around 40 per cent in the total production followed by Tur/Arhar at 15 to 20 per cent and Urad/Black Matpe and Moong at around 8-10 per cent each for the year 2013-14. Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh and Karnataka are the top five pulses producing States (NABARD rural pulse, 2015). Keeping in view the role of futures in stabilize the price fluctuation and mitigating the price risk which pave the way for improving farmers income, present study is conducted with the following objectives: To examine the long run associationship between the spot and futures prices of chickpea; to analyze the direction of relationship among price series and; to assess the short and long run causality between the spot and futures prices.

**DATA AND METHODOLOGY**

The daily data on spot and future market prices of chickpea were collected from the National Commodity Derivatives Exchange (NCDEX) website for the period January 2005 to December 2015. The monthly average of closing spot and future prices were then calculated and

used for the analysis. To examine the long run associationship, Johansen's Cointegration test was used. Besides, Pairwise Granger causality test and Vector Error Correction Model (VECM) was employed to know the direction of relationship and short run dynamics between the futures and spot price series respectively.

**Augmented Dickey Fuller test**

One of the pre-conditions for the cointegration technique is the data series should be stationary and integrated of the same order. To find the stationarity of spots and futures price series, Augmented Dickey Fuller (1979) test of following form was conducted.

$$\Delta P_t = \gamma P_{t-1} + \sum_{j=1}^p \delta_j \Delta P_{t-j} + \epsilon_{it}$$

Where,  $\gamma$  is the coefficient of  $P_{t-1}$ ,  $p$  is the lag order of the autoregressive process,  $\Delta P_t = P_t - P_{t-1}$  are first differences of  $P_t$ ,  $P_{t-1}$  are lagged values of order one of  $P_t$ ,  $\Delta P_{t-j}$  are changes in lagged values, and  $\epsilon_{it}$  is the white noise. The parameter of interest in the ADF model is  $\gamma$ . For  $\gamma = 0$ , the  $y_t$  sequence contains the unit root and hence is integrated of order  $d = 1$ .

In order to apply the Johansen procedure, a lag length must be selected for the VAR model. It was selected on the basis of different criteria viz., sequential modified LR test statistic, Final prediction error (FPE), Akaike information criterion (AIC), Schwarz information (SC), and Hannan-Quinn information criterion (HQ).

**Johansen's Cointegration Test:** Once the series becomes stationary and integrated of the same order and lag length was selected cointegration was tested by using the following model.

$$\Delta P_t = \sum_{i=1}^{k-1} \Gamma_i \Delta P_{t-i} + \Pi P_{t-k} + \mu + \beta t + \epsilon_t$$

Where  $\Gamma_i = (1 - \Pi_1 - \dots - \Pi_i)$ ;  $i=1, 2, \dots, k-1$ ;  $\Pi = (1 - \Pi_1 - \dots - \Pi_k)$ . Each of  $\Pi_i$  is an  $n \times n$  matrix of parameters;  $\epsilon_t$  is an identically and independently distributed  $n$  dimensional vector of residuals with zero mean and variance matrix,  $\mu$  is a constant term and  $t$  is trend. It is the  $\Pi$  matrix that conveys information about the long-run relationship among the variables in  $P_t$ . To detect the number of cointegrating vectors, Johansen proposed two likelihood ratio tests viz.,

The trace test and maximum eigen value test statistic which are formulated as:

$$\text{trace} = -T \sum_{i=r+1}^n \ln(1 - \lambda_i)$$

$$\text{max} = -T(1 - \lambda_{r+1})$$

Where,  $T$  is the sample size, and  $\lambda_i$  is the  $i^{\text{th}}$  largest canonical correlation.

**Granger Causality**

Cointegration test is only about whether there is any relationship between two series or not, further it does not show the direction of relationship i. e. whether unidirectional or bi directional. It is Granger causality test which examine the direction of relationship between two series. Here, the null hypothesis is no causality

between futures and spot prices. The rejection of the null hypothesis implies that the information transmission from spot prices to future prices and vice versa. If the lags of both series are significant, there is a bi-directional flow of information. The equations for the test are specified as:

$$F_t = a_0 + a_1F_{t-1} + \dots + a_pF_{t-p} + b_1S_{t-1} + \dots + b_pS_{t-p} + u_t$$

$$S_t = c_0 + c_1S_{t-1} + \dots + c_pS_{t-p} + d_1F_{t-1} + \dots + d_pF_{t-p} + v_t$$

Where, F and S refer to futures and spot prices, u, v are white noises (Kumar, 2015).

**Vector Error Correction Model (VECM)**

To determine the long and short run causal relationship among the cointegrated variables i.e., spot (S<sub>t</sub>) and futures prices (F<sub>t</sub>), following Vector Error Correction Model (VECM) is used (Srinivasan, 2011).

$$\Delta S_t = \alpha_s + \sum_{i=1}^n \beta_{si} \Delta S_{t-i} + \sum_{i=1}^n \theta_{si} \Delta F_{t-i} + \gamma_s Z_{t-1} + \varepsilon_{st}$$

$$\Delta F_t = \alpha_f + \sum_{i=1}^n \beta_{fi} \Delta S_{t-i} + \sum_{i=1}^n \theta_{fi} \Delta F_{t-i} + \gamma_f Z_{t-1} + \varepsilon_{ft}$$

where fi denotes first difference operator, α<sub>s</sub> and α<sub>f</sub> are intercepts and ε<sub>st</sub> and ε<sub>ft</sub> are white-noise disturbance terms. β<sub>s</sub>, β<sub>f</sub>, θ<sub>s</sub>, θ<sub>f</sub>, γ<sub>s</sub> and γ<sub>f</sub> are parameters. Z<sub>t-1</sub> is the Error-Correction Term (ECT), which measures how the dependent variable adjusts to the previous period's deviation from long-run equilibrium:

$$Z_{t-1} = S_{t-1} - \alpha - \delta F_{t-1}$$

where δ is the cointegration vector and α is the intercept.

The null hypothesis that there is short run causality from futures prices to spot prices is formulated as, θ<sub>s1</sub>=θ<sub>s2</sub>=...θ<sub>sn</sub>=0 while when spot prices cause futures prices in short run the null is: β<sub>f1</sub>=β<sub>f2</sub>=...=β<sub>fn</sub>=0.

**RESULTS AND DISCUSSION**

The analysis is performed by using the E Views software. The result of stationarity test are given in the Table 1. The results show that at level test statistic for both futures and spot prices is smaller than test critical values at 1, 5, and 10per cent level of significance. It results into acceptance of null hypothesis i.e. the price series has unit root. Thus both future and spot prices are non-stationary at level.

The table further shows that the model variables are integrated of order one I (1) after first differencing. At first difference test statistic values of both futures and spot

prices are greater than test critical values at all level of significance. It means the null hypothesis is not accepted and both futures and spot price series do not have unit root and are stationary at their first difference.

Once the both futures and spot price series become stationary and integrated of the same order i.e., 1 the lag length was selected to proceed for the cointegration test. The lag length of order 1 was selected for the model as determined by SC, HQ and LR lag order selection criteria. After selecting the lag length, Johansen's Cointegration test was performed to examine the long-run relationship between spot and future market prices of chickpea and its result are presented in Table 2. The results provide evidence in favour of cointegration between the futures and spot prices of chickpea. The null hypothesis of r = 0, indicates an absence of a cointegration between two price series. Table shows that this null hypothesis is not accepted at 5per cent significance level as calculated value is greater than the critical value for both trace and maximum eigen value test.

The table further reveals that another null hypothesis of at most one cointegrating equation i.e., r<0 is accepted at 5 per cent level of significance in both trace and maximum eigen value test. In this case the test statistic value is less than the critical value and p value is greater than 0.05 in both tests which results into acceptance of null hypothesis. Thus the results shows that there is one cointegrating equations between spot and futures prices of chickpea. Hence, it was concluded that there exists a long run associationship between the two prices series of chickpea.

Cointegration test indicated only the long run relationship between the price series but, the direction of relationships were examined by Granger causality test. The respective results are presented in the Table 3. Results show that the null hypothesis i.e. futures does not Granger cause spot is not accepted as the p value is less than 0.05. It indicates that the futures prices lead to the spot prices of chickpea. The results further reveal that the another null hypothesis is accepted at 5 per cent level of significance which shows that there is unidirectional relationship between the two price series and is form futures to spot which implies that it is the spot market prices which are influenced by the futures prices of chickpea.

**Table 1: Augmented dickey fuller unit root test results**

Variable	t- Statistic	Test critical values			p-value	
		1 per cent	5 per cent	10 per cent		
Futures prices	At level	0.666*	-2.583	-1.943	-1.615	0.859
	At first difference	-10.548**	-2.583	-1.943	-1.615	0.000
Spot prices	At level	-0.520*	-2.583	-1.943	-1.615	0.490
	At first difference	-16.448**	-2.583	-1.943	-1.615	0.000

\*Denotes acceptance of null hypotheses at all levels

\*\* Denotes rejection of null hypotheses at all levels

**Table 2: Johansen cointegration test statistics for futures and spot prices of chickpea**

Rank	Trace test			Maximum Eigen value		
	Calculated value	Critical value	p value	Calculated value	Critical value	p value
$H_0: r = 0$	16.81828*	15.49471	0.0314	14.62990*	14.26460	0.0438
$H_0: r < 1$	2.188379	3.841466	0.1391	2.188379	3.841466	0.1391

\* denote rejection of the null hypothesis at the 5per cent level

**Table 3: Pairwise Granger causality tests**

Null hypothesis	F-Statistic	Prob.	Direction	Relationship
Futures does not Granger cause spot	19.5379	0.000*	Unidirectional	Futures spot
Spot does not Granger cause futures	2.01005	0.1587		

\* indicates significance at 5 per cent level of significance

**Table 4: Estimated vector error correction model for futures and spot prices**

Variables		Coefficient	Std. Error	t-statistic	P value
fiSpot	$ECT_{t-1}$	-0.301*	0.078	-3.850	0.0002
	fiSpot(-1)	-0.274	0.089	-3.087	0.0025
	fiFutures(-1)	0.244	0.159	1.536	0.127
	Constant	10.090	31.433	0.321	0.749
fiFutures	$ECT_{t-1}$	0.041**	0.030	1.373	0.172
	fiSpot(-1)	0.001	0.057	0.024	0.981
	fiFutures(-1)	-0.001	0.102	-0.014	0.989
	Constant	22.150	20.197	1.097	0.275

\*denotes significant variables at 5 per cent levels.

\*\* denotes insignificant variables at 5 per cent levels

Since the spot and futures prices were cointegrated, VECM was used to check the long run causality between two price series. The results are presented in Table 4. The results show two error correction models viz., one with first difference spot prices (fiSpot) as a dependent variable and another one is the model where first difference futures prices (fiFutures) is taken as the dependent variable. The coefficient of error correction term in first model that is where fiSpot is a dependent variable, is significant and negative which means that futures prices has a long run causality on spot prices. The table further shows that there is no short run causality from one lag futures prices to spot prices as the coefficient of fiFutures(-1) is not significant.

The results further reveals that the error correction coefficient of second model i.e., where fiFutures is taken as dependent variable, is not significant which indicates that there is no long run causality from spot prices to futures prices. Also the coefficient of fiSpot(-1) is insignificant which means that there is no short run causality from one lag spot prices to futures prices. Further to examine the efficiency of model, Breusch-Godfrey test was used to check the serial correlation, ARCH test was conducted and Jarque Bera statistic was used to find out the normality of the residuals. The study finds that model do not have serial correlation and ARCH effect but the only problem is residuals are not normally

distributed which makes the model doubtful but one can accept the model.

## CONCLUSIONS

Futures as an instrument of price risk mitigation and a tool for price discovery, can play an important role in achieving the objective of doubling farmers' income by 2022. Present study was conducted on futures trading of chickpea as pulses are suffering from the price volatility most since the past few years. The data of futures and spot prices of Chickpea for the period January 2005 to December 2015 were collected from NCDEX. Price discovery is confirmed when there is a long run associationship between two stationary price series which are integrated of same order. To examine the same, Johansen Cointegration test was used which resulted into long run associationship between the series. Further, Granger causality results revealed the unidirectional relationship between both i.e. from futures to spot prices. VECM estimates indicated that there was long run causality from futures prices to spot prices of chickpea. The cointegration results were consistent with the findings of the study conducted by Sehgal *et al.* (2012) and Elumalai *et al.* (2011) where as long run causality results were same as the study of Chhajer *et al.* (2013). The study concluded that the futures prices can forecast the spot prices as there was a causality from former to later. This can be used as an important decision making tool by the farmers, to plan their

cropping pattern, purchase and selling activities and other kind of investments. A judicious use of these disseminated price signals will help the farmers to improve their real income significantly. The study suggests that there is a need to develop futures contract for all other major pulse varieties so that the negative consequences of price volatility can be managed and income of all the pulse growing farmers can be improved.

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## Impact of GST on Agriculture: A Review

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### ABSTRACT

Goods and Services Tax is a single and a broad based tax levied on goods and services consumed in an economy. Agricultural sector has been the root of Indian economy and it contributes to around 17.4 per cent to GDP. About 52 per cent of the total rural livelihood depends on this sector as their primary means of livelihood, so it is important to study the impact of GST on the Agriculture sector. GST will have both positive and negative effect on Agriculture. GST is expected to create a business friendly environment, as price level and inflation rate go down. Good and Service tax has single tax structure as it leads to unified market at national level for goods and services. The implementation of GST is expected to bring uniformity across states and centre which would make tax support policy of a particular commodity effective. Good and Services Tax (GST) was predicted to have a simple harmonized tax structure with operational ease leading to a single unified market at national level for goods and services while ensuring that there is no negative revenue impact on the states. This paper is helpful in bringing out the light on Impact of GST on Agriculture Sector.

### Keywords

Agricultural commodities, GST, VAT, indirect tax

### JEL Codes

H70, H71

### INTRODUCTION

Agriculture is one of the most critical sectors of the Indian economy. Growth and development of agriculture and allied sector directly affects well-being of people at large, rural prosperity and employment and forms an important resource base for a number of agro-based industries and agro-services. The agriculture sector in India has undergone significant structural changes in the form of decrease in share of GDP from 30 per cent in 1990-91 to 17.4 in 2015-16 (Annual Report, 2015-16 MoA & FW) indicating a shift from the traditional agrarian economy towards a service dominated one. However, this decrease in agriculture's contribution to GDP has not been accompanied by a matching reduction in the share of agriculture in employment. About 52 per cent of the total workforce is still employed by the farm sector which makes more than half of the Indian population dependent on agriculture for sustenance (NSS 66<sup>th</sup> Round). Value addition in agriculture, thus, holds

huge potential for enhancing the living standard of majority of the people. Improved agriculture marketing offers a major opportunity to achieve this objective. Goods and service tax will have both negative and positive impact on agriculture. The price of agricultural commodities will go down, as previously the agricultural commodities are charged with different prices within the state, inter-state and in overall country. GST would lead to efficient allocation of resources. Terms of trade move in the favour of Agriculture as compared to manufacturing sector. This will increase prices of some commodities like milk, tea, etc. thus, boon the millions of farmers in India. In nut shell we can say that it will effect directly and indirectly to agriculture sector.

### Goods and Service Tax: What it is

GST stands for "Goods and Services Tax" and is proposed to be a comprehensive indirect tax levy on manufacture, sale and consumption of goods as well as services at the national level. GST is an idea on which all

the indirect taxes (by central government, state government and custom duties) will be subsumed into a common single GST. The proposed GST is expected to streamline the indirect tax regime. It contains all indirect taxes levied on goods, including central and state-level taxes. Act as an improvement on the VAT system, a uniform GST is expected to create a seamless national market. GST seems to be more comprehensive, compliant, simple, harmonized and development oriented tax system. Main aim of GST is “**one nation, one tax**”. From the consumer point of view, the biggest advantage would be in terms of a reduction in the overall tax burden on goods, which is currently estimated to be around 25-30 per cent (Central Board of Excise and Custom). Introduction of GST would also make Indian products competitive in the domestic and international markets. After GST, when a single taxation procedure will roll out we can say that inflation will come down. We can expect that the rate of taxation on necessary materials like agriculture product, medicines will be low or must be exempted. It will spread the positive energy to the people of the nation.

#### Features of Indian GST

- It will be collected on VAT method i.e. tax at every stage of value addition.
- It will be imposed at an uniform rate @20 per cent (**Centre state share = 12 and 8 per cent respectively**)
- Indian government will also apply an integrated GST that means only Centre can collect GST in case of inter-state trade and commerce and further this tax will be divided between Centre and state based on recommendation of GST council advisory body. Furthermore, indirect tax will not be subsumed into GST.

#### Why this much hue and cry from different states?

- The governments of Madhya Pradesh, Chhattisgarh and Tamil Nadu arguing that the 'information technology systems and the administrative infrastructure so needed will not be ready by April 2010 to implement GST'.
- Some states fear that if the uniform tax rate is lower than their existing rates, it will hit their tax kitty. The government believes that dual GST will lead to better revenue collection for States.
- Backward and less-developed States could see a fall in tax collections. GST could see better revenue collection for some states as the consumption of goods and services will rise. However, states have sought assurances that their existing revenues will be protected.
- The central government has offered to compensate States in case of a loss in revenues.

#### GST: New for nothing?

- Central sales tax (goods movement) will continue in different form (i.e. integrated GST)

and Central sale tax will be collected by central government for first two years but depending on the recommendation of GST council it may be extended further and thus disturbing the very purpose of introducing GST.

- Certain items are exempted from GST like
  1. Alcoholic liquor
  2. Aviation turbine fuel/high speed diesel
  3. Petrol
  4. Stamp duty
  5. Customs duty

But it is very well known that 40 per cent of state government revenue is from these items and thus the very purpose of introducing GST is at stake.

GST is expected to build a business friendly environment, as it leads to charge a uniform tax rate. Indian economy is highly affected by the indirect taxes like service tax, VAT tax, duties sales tax etc. They are all affecting Indian economy in different area because most of indirect tax applied by state government in their particular state and that make differentiation in the form of rate of indirect taxes. Rahul Bajaj, chairman of the Bajaj Group, told Reuters in November 2012. Some states fear that a uniform tax rate, if lower than their existing rates, will dent collections. However, the central government has said it will compensate states for the potential revenue loss. Mr. Chidambaram (former finance minister) has set aside Rs. 9,000 Crore towards the first installment of the balance of central sales tax (CST) compensation.

#### Views on GST

Shaik *et al.* (2015) have same view about GST, they said that GST acts as helper in the collective gain for industry, trade, agriculture and common consumers as well as for the Central Government and the State Government and thus ultimately helpful in development of Indian economy. It was further reported that GST will lead to provide commercial benefits, which were remained untouched by the VAT system. Jaiprakash had same view that GST at Central and State levels are expected to give more relief to agriculture, industry and consumers. He also indicated that trade and industry have encouraging responses to GST. Thus GST offers us the best option to broaden our tax base and we should not miss this opportunities to introduce it when the circumstances are quite favorable and economy is enjoying steady growth with only mild inflation.

Overall GST is helpful for the development of Indian economy as well it will be very much helpful in improving the gross domestic product of the country more than two percent mention by Chaurasia *et al.* (2016) in their study.

Chadha *et al.* (2009) has analyzed that GST would lead to efficient allocation of factors of production. The overall price level would go down. It is expected that the real returns to the factors of production would go up. Their results showed gains in real returns to land ranging between 0.42 and 0.82 per cent. Wage rate gains varied

between 0.68 and 1.33 per cent. The real returns to capital would gain somewhere, between 0.37 and 0.74 per cent. In sum, implementation of a comprehensive GST in India is expected to lead to efficient allocation of factors of production thus leading to gains in GDP and exports. This would translate into enhanced economic welfare and returns to the factors of production, viz. land, labour and capital.

Satish Chander, Director General, FAI said that fertiliser products are likely to suffer from higher incidence of taxes with implementation of GST. Therefore, it is strongly felt that there is a need for the government to pay special attention to fertiliser sector, keeping in view its direct linkage with farmers and agriculture. Any new tax regime should not directly or indirectly increase the cost of fertilisers to the farmers, especially when government continues to provide subsidy on fertiliser directly or indirectly. Prima facie, the government should thus; either allows zero or concessional rate of GST on fertilisers.

Nirmal Khurana, Chairman of the ITA's said that tea is a product of mass consumption; it should have a special rate under the GST regime. , GST rate on tea should be kept on a par with the current tax rate of 5-6per cent. The present concessional tax rate of 0.5/1per cent for teas sold through auctions is allowed to continue under the GST regime. Otherwise, tea will become costlier.

#### Impact of GST on Farm sector:

- The execution of GST is expected to boost the agricultural market as taxation under a subsumed single rate would make the movement of agricultural commodities hassle free as the products would be able to reach places via trucks in a better way.
- Interstate trading of a particular product often is subjected to various taxes, permission, license required for different states at every point of their transaction. This had often created hindrance in trading of products across the country for many traders in the past. So implementing GST would be the first step towards liberalizing the marketing of agricultural products and creating a smooth transaction of goods.
- GST would make the agro-machineries affordable to the small and marginal farmers in India which was beyond their reach due to high excise duty on the machinery.
- Agricultural products were always subject to diversity in the taxation rates so a single rate of goods and service tax would benefit the national agricultural market and help the farmers and traders to sell their products in any part of the country and receive the best price for their product.
- The proposed GST rate should provide consistency in tax of processed and unprocessed food items so that processed food comes within the reach of all the consumers. The slab for GST

rate of processed food should be different for different income group to make the benefit of such food available for all the consumers.

- Currently, there is no tax to procure milk from farmers. We only pay 2 per cent central VAT on sale of milk powder to a company. When GST gets implemented, the tax can be 12.5per cent or 15per cent or 18per cent. There will be a straight cost hike in milk and milk product prices. India ranks first in milk production covering around 18.5per cent of the world production. Its annual production for the year 2015-2016 amounted to 155.49 million ton (Indiastat) and records an increase every year, and milk being a basic necessity in many households, an increase in the price would not be readily welcomed by the consumers.
- The implementation of GST is expected to facilitate the implementation of National Agricultural Market on account of subsuming all kinds of taxes/cess on marketing of agricultural produce as well as it would ease interstate movement of agricultural commodities which would improve marketing efficiency, facilitate development of virtual markets through warehouses and reduce overhead marketing cost.

#### CONCLUSIONS

It can be said from the above that GST is expected to have both positive and negative impact on the farm sector. In case of milk, Tea and Fertilizer it is expected to show a negative impact. These are the most popular commodities in India. In case of milk there is no tax to procure milk from farmer, when GST will be implemented it leads to increase the milk prices and this would not be welcomed by consumers. GST will make tax system more transparent as single tax system is available to whole country. Agricultural products were subjected to diversity of taxation rates; as single rate of goods and service tax would help the farmers and also to traders because they can sell their produce in any part of the country.

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## Historic! One Nation, One Tax GST

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### ABSTRACT

India is a federal country where both the Centre and the States have been assigned the powers to levy and collect taxes through appropriate legislation. India has chosen the Canadian model of dual GST. A dual GST will, therefore, be in keeping with the Constitutional requirement of fiscal federalism. The Central GST and the State GST would be levied simultaneously on every transaction of supply of goods and services except the exempted goods and services, goods which are outside the purview of GST and the transactions which are below the prescribed threshold limits.

### Keywords

Federalism, Government, tax, tax credit mechanism, tax rate, threshold limit

### JEL Codes

H21, H26, H71, K34

### INTRODUCTION

The introduction of Goods and Services Tax (GST) would be a significant step in the reform of indirect taxation in India (Kumar, 2016). Amalgamating several Central and State taxes into a single tax would mitigate cascading or double taxation, facilitating a common national market. The simplicity of the tax should lead to easier administration and enforcement. As India is a federal republic GST would be implemented concurrently by the central government and by state governments. The Country has implemented Indian Goods and Services Tax, which is said to be by far the most radical reform which the Government of India would have ever implemented. The taxation system in India was laced with complexity, multiplicity and ambiguity. The plague of cascading effect of taxes, was to some extent, mitigated with the introduction of CENVAT in the year 1986 at the Central level and further with the introduction at the State level, with a Value Added Tax system for most part of the Country, in the year 2005. Considering multiple taxes levied by the Centre and the State and absence of the facility to offset the incidence of one tax with another in most cases, the effect of cascading gets built into the transaction cost.

GST is one indirect tax for the whole nation, which will make India one unified common market. It is a single

tax on the supply of goods and services, right from the manufacturer to the consumer. Credits of input taxes at each stage will be available in the subsequent stage of value addition, which makes GST essentially a tax only on value addition at each stage. The final consumer will thus bear only the GST charged by the last dealer in the supply chain, with setoff benefits at all the previous stages.

### GST-Administered In India

Keeping in mind the federal structure of India, there will be two components of GST Central GST (CGST) and State GST (SGST). Both Centre and States will simultaneously levy GST across the value chain. Tax will be levied on every supply of goods and services. Centre would levy and collect Central Goods and Services Tax (CGST), and States would levy and collect the State Goods and Services Tax (SGST) on all transactions within a State. The input tax credit of CGST would be available for discharging the CGST liability on the output at each stage. Similarly, the credit of SGST paid on inputs would be allowed for paying the SGST on output. No cross utilization of credit would be permitted.

### How does it Work?

GST is a tax on goods and services with comprehensive and continuous chain of setoff benefits from the producer's point and service provider's point

upto the retailer's level. It is essentially a tax only on value addition at each stage, and a supplier at each stage is permitted to setoff, through a tax credit mechanism, the GST paid on the purchase of goods and services as available for setoff on the GST to be paid on the supply of goods and services. The final consumer will thus bear only the GST charged by the last dealer in the supply chain, with setoff benefits at all the previous stages. The illustration shown below indicates, in terms of a hypothetical example with a manufacturer, one wholesaler and one retailer, how GST will work. Let us suppose that GST rate is 10 per cent, with the manufacturer making value addition of ₹30 on his purchases worth ₹100 of input of goods and services used in the manufacturing process. The manufacturer will then pay net GST of ₹3 after setting of ₹10 as GST paid on his inputs (*i.e.* Input Tax Credit) from gross GST of ₹13. The manufacturer sells the goods to the wholesaler. When the wholesaler sells the same goods after making value addition of (say), ₹20, he pays net GST of only ₹2, after setting off of Input Tax Credit of ₹13 from the gross GST of ₹15 to the manufacturer. Similarly, when a retailer sells the same goods after a value addition of (say) ₹10, he pays net GST of only ₹1, after setting off ₹15 from his gross GST of Rs. 16 paid to wholesaler. Thus, the manufacturer, wholesaler and retailer have to pay only ₹6 (=₹3+₹2+₹1) as GST on the value addition along the entire value chain from the producer to the retailer, after setting off GST paid at the earlier stages. The overall burden of GST on the goods is thus much less. This is shown in Table 1. The same illustration will hold in the case of final service provider as well (Empowered Committee Report, 2016).

#### Dual GST in India

India is a federal country where both the Centre and the States have been assigned the powers to levy and collect taxes through appropriate legislation. Both the levels of Government have distinct responsibilities to perform according to the division of powers prescribed in the Constitution for which they need to raise resources. India has chosen the Canadian model of dual GST. A dual GST will, therefore, be in keeping with the Constitutional

requirement of fiscal federalism.

#### GST Slab Rates

1. Zero rated items: Food grains used by common people.
2. 5 per cent Rate: Items of mass consumption including essential commodities will have low tax incidence.
3. 12 per cent and 18 per cent Rate: Two standard rates have been finalized as 12 per cent and 18 per cent.
4. 28 per cent Rate: White goods like Air conditioners, washing machines, refrigerators, soaps and shampoos etc. that were taxed at 30-31 per cent shall be now taxed at 28 per cent.

Demerit goods like tobacco, tobacco products, pan masala, aerated drinks and luxury cars shall be charged at the highest rate of 28 per cent. An additional cess on some luxury goods shall also be imposed. Services that are now taxed at 15 per cent shall be taxed at a higher rate of GST at 18 per cent.

#### Impact of GST on Indian Economy

**Reshapes indirect tax structure:** The GST will reshape the indirect tax structure by a subsuming majority of indirect taxes like excise, sales and services levies. This will do away with the complex indirect tax structure of the country, thus improving the ease of doing business in the country.

**Exports:** Exports will become competitive as the GST regime will eliminate the cascading impact of taxes. A National Council of Applied Economic Research study suggested that GST could boost India's GPP growth by 0.9-1.7 per cent. GST is a key 'brahmastra' for India's gross domestic product in times of challenging global environment.

**Gross domestic product:** In terms of growth impact on GST implementation, the near-term could be messy, with adjustment costs for the private sector grappling with inter-sector implications, and the central government trying to compensate states for revenue loss. If the GST rate is set at around the 17-18per cent, service producers would face an increased tax burden while manufacturers

**Table 1: Estimated tax burden after GST implementation**

Particulars	Stages of supply chain		
	Manufacturer	Wholesaler	Retailer
Purchase value of input	100	130	150
Value addition	30	20	10
Value at which supply goods and services made to next stage	130	150	160
Rate of GST (per cent)	10	10	10
GST on output	13	15	16
Input Tax Credit	10	13	15
Net GST=GST on output-Input tax credit	13-10=3	15-13=2	16-15=1

Source: Empowered Committee Report, 2016

would see a fall. That could cause manufacturers to not pass through benefits and service providers to pass on costs, moves that would lower consumption and overall growth. At present, the effective indirect tax rates on goods and services are 22.5 percent and 15 percent, respectively.

**Inflation:** Initially, the implementation of the GST in the near-term could bring some upturn in inflation; however, the impact should be transitory. The service tax rate could shoot up from the current level of 15 percent (including Krishi Kalyan Cess). Under the GST tax regime, this tax rate may go up to 18 percent. This has led to fears that inflation could rise in the short term. A revenue-neutral rate (RNR) of 15 percent with a low rate of 12 percent and a standard rate of 18 percent would have a negligible inflation impact. But a higher RNR with a lower rate of 12 percent and a standard rate of 22 percent meanwhile, would have a 0.3-0.7 percentage point impact on aggregate inflation, it continued. Consumer price inflation (CPI) could rise by 0.2 percentage points if the GST rate is kept at 18 percent. If the rate is set at 22 percent, CPI could increase by 0.7 percentage points.

**Foreign exchange:** The passing of the GST will be welcome news for the ₹. So far, the currency has yet to see a GST boost. It is believed that GST will lead to higher foreign direct investment inflows and a narrow current account deficit-factors that should help the INR eventually outperform other Asian and emerging market currencies.

**Impact of GST on make-in-india:** The *Make in India* campaign is proposing to make India a world-class manufacturing hub. The tax reforms through GST will play a crucial role to attract large-scale investment. The impending Goods and Service Tax (GST) promises a progressive tax system which avoids tax cascades and helps establish India as a true common market. GST will reduce the cost of production and allows the hassle free supply of goods. This can increase the ease of doing business India.

**Unification of market:** GST will lead to the creation of a unified market, which would facilitate seamless movement of goods across states and reduce the transaction cost of businesses. A UBS Securities study found that truck drivers in India spend 60 percent of their time off roads negotiating check posts and toll plazas. The foreign brokerage said that 11 categories of taxes are levied on the road transport sector. The GST will help bring down logistical costs.

**Credit to manufactures:** Under the GST, manufacturers will get credits for all taxes paid earlier in the goods/services chain, thus incentivizing firms to source inputs from other registered dealers. This could bring in additional revenues to the government as the unorganized sector, which is not part of the value chain, would be drawn into the tax net.

**Credit to dealers:** To claim input tax credit, each dealer has an incentive to request documentation from the dealer

behind him in the value-added/tax chain. Thus, the new tax regime is seen as less intrusive, more self-policing, and hence more effective way of reducing corruption.

**Clean-up India:** The clean-up of the Indian taxation system will reduce the number of excise duty exemptions. According to the government's estimates, excise tax exemptions result in foregone revenues of ₹1.8 lakh crore. The comparable figure for the states is about ₹1.5 lakh crore. Together, India loses about 2.7 percent of GDP because of exemptions (Kothari, 2016)

#### **Implications of GST on Common Man**

A new law, a new tax will bring with it new challenges to face that need to be tackled with utmost care. GST bill covers the Goods and Services Tax and shall be the biggest indirect tax reform providing a uniform and simplified way of Indirect taxation in India. Once introduced GST will replace a number of other indirect taxes like VAT, CST, Service tax, CAD, SAD, Excise, Entry tax, purchase tax etc. So, a bundle of indirect taxes will get replaced by a new tax in India known as GST or Goods and Services Tax. Hence, leading to a much simplified tax regime as compared to the earlier complicated tax structure comprising of numerous taxes (Debu, 2016).

#### **Positive impact of GST on the common man**

- A unified tax system removing a bundle of indirect taxes like VAT, CST, Service tax, CAD, SAD, Excise etc.
- Less tax compliance and a simplified tax policy as compared to earlier tax structure.
- Removes cascading effect of taxes i.e. removes tax on tax.
- Due to lower burden of taxes on the manufacturing sector, the manufacturing costs will be reduced, hence prices of consumer goods likely to come down.
- Due to reduced costs some products like cars, FMCG etc. will become cheaper.
- This will help in lowering the burden on the common man i.e. you will have to shed less money to buy the same products which were earlier costly.
- The low prices will further lead to an increase in the demand/consumption of goods.
- Increased demand will lead to increase supply. Hence, this will ultimately lead to rise in the production of goods.
- The increased production will lead to more job opportunities in the long run. But, this can happen only if consumers actually get cheaper goods.
- It will curb circulation of black money. This can happen only if the “kacha bill” system, normally followed by traders and shopkeepers is put to check.
- A unified tax regime will lead to less corruption

which will indirectly affect the common man.

- Most importantly, GST will help to boost the Indian economy in the long run.

#### **Negative impact of GST on the common man**

- Service tax rate @ 15 per cent is presently charged on the services. So, if GST is introduced at a higher rate which is likely to be seen in the near future, the cost of services will rise. In simple words, all the services like telecom, banking, airline etc. will become more expensive.
- Increased cost of services means, an add on to your monthly expenses.
- You will have to reschedule your budgets to bear the additional services cost.
- An increase in inflation might be seen initially.
- Being a new tax, it will take some time for the people to understand it completely. Its actual implications can be seen only when the rate of tax is determined.
- It is easier said than done. There are always some complications attached. It is a consumption based tax, so in case of services the place where service is provided needs to be determined.
- If actual benefit is not passed to the consumer and the seller increases his profit margin, the prices of goods can also see a rising trend.
- A strict check on profiteering activities will have to be done, so that the final consumer can enjoy the real benefits of GST.
- Although, a large number of officers are being trained and a systematic IT software is being developed for the successful implementation of GST. But, it will take some time for the people including the manufacturers, the wholesalers, the retailers or the final consumers to understand the whole process and apply it correctly.

However, GST or Goods and Services tax is a long term strategy planned by the Government and its positive impact shall be seen in the long run only. Also, this can happen if GST is introduced at a nominal rate to reduce the overall tax burden of the final consumers.

#### **GST Implication on Agriculture Sector in India**

- The biggest strength of GST is that we will have a single tax without the cascading effect of multiple taxes, so only value addition is taxed at each point.
- We only pay 2 per cent central VAT on sale of milk powder to a company. When GST gets implemented, the tax can be 15 per cent or 18 per cent. There will be a straight cost hike in milk and milk products prices.
- Tea is the most popular thing in India after water. Tea industry feels that it should be exempted from GST. In case full exemption of GST is not possible, GST rate on tea should be kept on a par

with the current tax rate of 5 per cent, otherwise, tea will become costlier.

- Food prices may rise in the initial phase of GST but the proposed tax will bring in several benefits for the industry and consumer's Agricultural products will be able to reach more areas as trucks carrying perishable commodities will be able to cover longer distances without hindrance.
- Tax on Basmati rice will decrease as GST is a welcome move as there will be more transparency in the system. There will be a common market in the absence of CST (12per cent) and entry tax (9per cent).
- In India, many of the food items have been exempted from the CENVAT, while cereals and food grains are liable for the state VAT of 4 per cent. While the other unprocessed food such as meat and eggs, coarse grains, fresh fruits, and vegetables come under the restricted state VAT category.
- In the rural sector, the predominant distribution channel for unprocessed food would be either a direct sale by the farmer to final consumers or through small distributors/retailers. Even where food is within the scope of the GST, such sales would largely remain exempt because of the small business registration threshold.

#### **Threshold exemption for GST**

Threshold exemption is built into a tax regime to keep small traders out of tax net. This has threefold objectives:

- a. It is difficult to administer small traders and cost of administering of such traders is very high in comparison to the tax paid by them.
- b. The compliance cost and compliance effort would be saved for such small traders.
- c. Small traders get relative advantage over large enterprises on account of lower tax incidence.

#### **POINTS TO PONDER**

The GST is a very good type of tax. However, for the successful implementation of the same, we must be cautious about a few aspects. Following are some of the factors that must be kept in mind about GST:

- Firstly, it is really required that all the states implement the GST together and that too at the same rates. Otherwise, it will be really cumbersome for businesses to comply with the provisions of the law. Further, GST will be very advantageous if the rates are same, because in that case taxes will not be a factor in investment location decisions, and people will be able to focus on profitability.
- For smooth functioning, it is important that the GST clearly sets out the taxable event. Presently, the CENVAT credit rules, the Point of Taxation Rules are amended/ introduced for this purpose only. However, the rules should be more refined

- and free from ambiguity (Nyshak, 2016).
- The GST is a destination based tax, not the origin one. In such circumstances, it should be clearly identifiable as to where the goods are going. This shall be difficult in case of services, because it is not easy to identify where a service is provided, thus this should be properly dealt with.
  - More awareness about GST and its advantages have to be made, and professionals really have to take the onus to assume this responsibility.

#### CONCLUSIONS

The introduction of Goods and Services Tax would be a very noteworthy step in the field of indirect tax reforms in India. By amalgamating a large number of Central and State taxes into a single tax, it would alleviate cascading or double taxation in a major way and pave the way for a common national market. From the consumer point of view, the biggest advantage would be in terms of reduction in the overall tax burden on goods and services.

Introduction of GST would also make Indian products competitive in the domestic and international markets. However, once implemented, the system holds great promise in terms of sustaining growth for the Indian economy.

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## **GST and its Implications on Farm Economy**

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### **ABSTRACT**

*Goods and services tax (GST) is a comprehensive tax levy on production, sale and consumption of goods and services at a national level. It is one of the biggest taxation reforms in the history of the country and it will integrate all the State economies and will help to boost the economic growth. Different types of indirect taxes are being paid by the industries and other sectors. With the implementation of GST all will cease to exist. The objective of the Government of India to double the farmer's income by 2022 is a major step towards farmer community. With the introduction of GST the farm economy will have mixed responses. It will affect people living in all the sections of the society. Taxation on farm economy will increase farmer's income and simultaneously it will impact the poor. The paper tries to study the concept of goods and services tax and its impact on farm economy. The study also attempts to analyze the significance and challenges in implementation of GST in Indian scenario.*

### **Keywords**

Agriculture, economic growth, farm sector, goods and services, tax taxation

### **JEL Codes**

H21, H 27, H 71, Q 10

### **INTRODUCTION**

India is a federal country and both Centre and States have their own rights to collect taxes. Each state is independent in levying and collecting taxes. The taxation powers are defined clearly in the Indian Constitution. Centre collects all the direct taxes (income tax, corporate taxes etc) along with the indirect taxes like Service Tax, Excise duty and Customs duty etc. The States collect indirect taxes like value added tax (VAT) on goods, central sales tax (CST) and local taxes. Earlier instead of VAT, States had sales taxes on various goods. Now states have replaced sales taxes with VAT. In an earlier taxation system, people paid taxes at various levels. There was no system of getting a rebate on the taxes paid previously while paying the inputs. This is also called as cascading effect.

The Centre was the first to adopt VAT with a selected group of commodities in 1986 and was called modified value added tax (MODVAT). The number of commodities was increased gradually in the form of central value added tax (CENVAT) in 2002-03.

The Service Tax was also made part of CENVAT in 2004-05. GST is an extended version of VAT and aims to

cover all goods and services. VAT covers mostly goods and GST covers all goods and services. GST is an attempt to get rid of weaknesses in the VAT structure. With a GST in place, all these indirect taxes should be merged into one tax (Shaik *et al.*, 2015).

Dr. Vijay Kelkar, Chairman of the Thirteenth Finance Commission has been one of the most vehement advocates of GST in India. Characteristics of a well-designed GST in a federal system are here as:

- Uniform rate of taxation within a given jurisdiction, ideally at a single rate;
- Sales would be taxed under the destination principle;
- Low costs of compliance and administration;
- Each level of government to set its own tax rate subject to agreed ceilings and/or floors;
- A substantively common tax base for Central and State governments;
- Substantial co-operation in tax administration between all levels of government.

### **Literature Review**

Gupta (2014) in her study stated that implementation

of GST in the Indian framework will lead to commercial benefits which were untouched by the VAT system and would essentially lead to economic development. Hence GST may usher in the possibility of a collective gain for industry, trade, agriculture and common consumers as well as for the Central Government and the State Government.

Jaiprakash (2014) in his study analyzed that the GST at the Central and the State level are expected to give more relief to industry, trade, agriculture and consumers through a more comprehensive and wider coverage of input tax set-off and service tax setoff, subsuming of several taxes in the GST and phasing out of CST. GST offers the best option to broaden tax base.

Venkadasalam (2014) has hypothesized the post effect of the GST on the national growth on ASEAN States using Least Squares Dummy Variable Model (LSDVM). He stated that seven of the ten ASEAN nations are already implementing the GST. He also suggested that the household final consumption expenditure and general government consumption expenditure are positively significantly related to the gross domestic product as required and support the economic theories. But the effect of the post GST differs in different countries. Philippines and Thailand show significant negative relationship with their nation's development. Meanwhile, Singapore shows a significant positive relationship.

#### **Research Problem**

The concept of GST is the biggest tax reform in decades throughout the world, but India has been taking baby steps to meet its target of rolling out GST on April 1, 2016. The research intends to focus on understanding concept of GST and its impact on Indian agriculture.

#### **Objectives of the Study**

- i. to study the concept of GST and its impact on Indian Economy in general and Indian agriculture in particular,
- ii. to understand how GST will work in India and
- iii. to know the advantages and challenges of GST in Indian context.

#### **Research Methodology**

The study focuses on extensive study of Secondary data collected from various books, National and International Journals, Government Reports, publications from various websites which focused on various aspects of GST.

#### **GST and Agriculture**

Agriculture plays a vital role in the Indian economy. Over 70 per cent of the rural households depend on agriculture as their principal means of livelihood. Agriculture, along with fisheries and forestry, accounts for one-third of the nation's GDP and is its single largest contributor. Agricultural exports constitute a fifth of the total exports of the country. With an annual output of 130 MT, India is the largest producer of the milk in the world. It also has the largest milk-producing animal population of over 118 million. However, milk yields per animal are

among the lowest in the world. India is the biggest producer of pulses in the world at 19 MT and their biggest importer 3.5 MT. India is the second largest producer of sugar in the world and the government has aimed to increase the exports from 1.3 MT in 2013 to an average of 2 MT in 2014 and 2015. Spice exports from India are expected to reach US\$ 3 billion by 2016-17. The Indian spices market is pegged at ₹40,000 crore (US\$ 6.42 billion) annually (www.icmai.in).

A tax on food is either borne by consumers through higher prices, or by farmers through reduced real income, or a combination of both. Both of these options are perceived to be regressive. There is however debate in the literature as many farmers have high incomes. The taxes applicable on agricultural trade in addition to the market fee also vary from state to state. The degree of market distortions on account of variation in the levy of market taxes applicable on different commodities in different states are presented in Table 1 below.

#### **Impact of GST**

The main issue in the application of GST to food is the impact it would have on those living at or below subsistence levels. Taxing food could thus have a major impact on the poor. By the same token, a complete exemption for food would significantly shrink the tax base. Food includes a variety of items, including grains and cereals, meat, fish, and poultry, milk and dairy products, fruits and vegetables, candy and confectionary, snacks, prepared meals for home consumption, restaurant meals, and beverages. In most jurisdictions where reduced rates or exemptions are provided for food, their scope is restricted to basic food items for home consumption.

In India, while food is generally exempt from the CENVAT, many of the food items, including food grains and cereals, attract the state VAT at the rate of 4 per cent in many States. However, exemption under the state VAT is restricted to unprocessed food, e.g., fresh fruits and vegetables, meat and eggs, and coarse grains. Beverages are generally taxable, with the exception of milk.

Introduction of GST will have significant outcome on Agricultural Sector. The Thirteen finance commission task force report on GST recommends exemption of GST on any unprocessed food article which is covered under Public Distribution System regardless of the outlet through which it is sold. Given that food is currently exempt from the CENVAT, the GST under a single-rate, comprehensive-base model would lead to increased tax burden on food. It is being suggested to consider a lower rate of GST on food, instead of complete exemption. However the lower rate has following implications:

- If the lower rate were to be 5per cent, the revenue neutral standard rate would be pushed up. This may be a reasonable compromise, provided all other goods and services are made taxable at the single standard rate of 16 per cent. The risk is that the lower rate for food would become the thin

**Table 1: Degree of market distortions**

Name of the state	Sales Tax	Taxes (as per cent of MSP)	Remarks
Andhra Pradesh	All Commodities (except Maize, Jowar, Ragi, Bajra, Coarse grains)	4	-
Bihar		3.0	-
Assam	All commodities (except rice, wheat, pulm, Fruits and vegetables, fish, gur, atta, maida etc.)	4-8	*Not collected as markets are not in operation
Chattisgarh		2.2	-
Delhi	Fruits and vegetables- nil, Oilseeds-3 per cent, Methi-7 per cent		-
Gujarat	Spices 3 per cent, Aniseed 2 per cent, Cotton 4 per cent, Isabgol 2 per cent, Cummin 2 per cent, Ajwain 2 per cent	0.8	Other agricultural commodities exempted from Sales tax Octroi 0.2 to 4 per cent
Goa	Betelnut 2 per cent, Cashewnut 2 per cent, Coconut, Fruits and vegetables, Cattle & Milk exempted from Sales Tax		Entry Fee Cattle- ₹10/head Vehicle- ₹10/truck
Jharkhand		1.0	-
Haryana	Fruits and vegetables nil, Food grains 4 per cent, Pulses 4 per cent, Oilseeds 4 per cent	11.5	-
Himachal Pradesh		5.0	-
Karnataka	Foodgrains-nil, Pulses -2 per cent, Oilseeds-4 per cent		Market fee exempted for Industrial and Export Purchases.
Kerala		4 -8	There is no market regulation and hence no prescribed charges.
Madhya Pradesh	NA	9.2	Development cess from traders only-1 to 5 per cent.
Maharashtra	All agricultural commodities are exempted from Sales Tax	3.8	Entry fee ₹10/truck.
Punjab		14.5	-
Rajasthan	Fruits and vegetables nil, Foodgrains 4 per cent, Pulses & Oilseeds-2 per cent, Coarse grains-nil	3.6	Surcharge on Sales Tax-15 per cent
Tripura	Nil (for all agricultural commodities)		Entry fee ₹1/head
Uttar Pradesh	Foodgrains 4 per cent, Pulses-2 per cent, Oilseeds and Others- 4 per cent	16.71	
Uttarakhand		7.5	
West Bengal	NA	2.5	Purchase Tax Jute 4 per cent

Source: Chaudhary Charan Singh National Institute of Agricultural Marketing, 2015

- edge of the wedge which would create irresistible demands for the opening the door wider.
- To keep the base broad, and limit the preference to items of consumption by the lower income households, the lower rate should be confined to 'unprocessed' food items (including vegetables, fruit, meat, fish, and poultry).
  - If wheat were taxable at 5 per cent as unprocessed food, but flour taxable at 16 per cent as processed food, it would encourage consumers to buy wheat and then have it processed into flour.
- Prices of agricultural items and services are expected

to rise after implementation of the GST, although the overall inflationary impact of the proposed indirect tax regime will be negative, former Finance Commission Chairman Vijay Kelkar said. Kelkar told the Parliamentary Standing Committee scrutinizing the GST Bill that while prices of agricultural commodities and services are expected to rise, most of the manufactured goods would be available at relatively low prices, especially textiles and readymade garments (The Economic Times, 2013).

The prices of agricultural goods would increase between 0.61 per cent and 1.18 per cent whereas the

overall prices of all manufacturing sector goods would decline between 1.22 per cent and 2.53 per cent. The increase in agricultural prices would benefit millions of farmers and the urban poor will also benefit from new employment opportunities. The prices of many other consumer goods, including, sugar, beverages, cotton textiles, wool, silk and textiles are expected to decline. The overall inflationary impact of GST will be negative through lower prices, lower fiscal deficit and higher output. GST will positively impact the common man in many ways. The benefits listed include the overall economic growth leading to new job opportunities (about 20 million high end jobs over a period of time), bring down inflation if GST is levied at the combined rate of 12 per cent and improve governance.

### **International Experiences**

Most countries have adopted VAT system and GST is considered similar to a VAT system. GST system has been adopted in economies like Canada, Australia, New Zealand and Singapore etc. Hong Kong proposed to introduce it but had to abandon it amidst stiff opposition. Over a long term, there are improvements across the macroeconomic variables but there were short-term glitches. Inflation did seem to rise in the years of introduction but was mainly blamed on the administration for the same. The impact on revenue and current account has been very impressive with sharp gains seen in all the three economies.

In Australia, there was a more dramatic impact of GST on the economy. Before GST's implementation, consumers rushed to purchase goods that they perceived would be substantially more expensive post-GST. After the tax, consumer consumption and economic growth declined sharply initially. In Q1 2000, Australian economy recorded negative economic growth for the first time in more than 10 years. Consumption and growth soon returned to normal. There was some negative impact on price of real estate as well but the market rose and

property prices and demand increased sharply in 2002-04.

GST increased the real output of the Canadian economy by 1.4 per cent of GDP, principally through an increase in the productivity of capital and total factor productivity. The sectors like transportation, utilities, services and agriculture experienced significant gains (Bolten and Dollery, 2004).

Above table shows GST rates being practiced in various countries in different years. The rates varied in different countries shows wide variations in the rates in different years.

### **Challenges of GST in Indian Context**

At present, lots of speculations are going as to when the GST will actually be applicable in India. Looking into the political environment of India, it seems that a little more time will be required to ensure that everybody is satisfied. The states are confused as to whether the GST will hamper their revenues. Although the Central Government has assured the states about compensation in case the revenue falls down, still a little mistrust can be a severe draw back. The GST is a very good type of tax. However, for the successful implementation of the same, there are few challenges which have to be faced to implement GST In India. Following are some of the factors that must be kept in mind about GST:

- Firstly, it is really required that all the states implement the GST together and that too at the same rates. Otherwise, it will be really cumbersome for businesses to comply with the provisions of the law. Further, GST will be very advantageous if the rates are same, because in that case taxes will not be a factor in investment location decisions, and people will be able to focus on profitability.
- For smooth functioning, it is important that the GST clearly sets out the taxable event. Presently, the CENVAT credit rules, the Point of Taxation Rules are amended/ introduced for this purpose

**Table 2: Impact of GST on various macroeconomic variables in the countries of Australia, New Zealand and Canada**

<b>Country (Introduction year) / Macroeconomic variables</b>	<b>Australia(2000)</b>	<b>New Zealand (1986)</b>	<b>Canada (1991)</b>
Price changes	Short run one off effect,	Short run spike in prices, no long run increase	Short run spike in prices, no long run increase, price regulatory body criticized
Economic growth	Introduced during sustained economic growth period	Introduced at the end of recession, subsequent upswing	Introduced in midst of major recession, criticized as compounding problems
Revenue effect	Revenue exceeded expectations	Revenue exceeded expectations	Revenue exceeded expectations
Current account dramatic	Slight improvement since introduction	Rapid immediate improvement, longer term stabilization	Dramatic improvement since introduction of GST, NAFTA

*Source: Bolton & Dollery (2004)*

**Table 3: Global GST rates in different years**

Country	Year of implementation	1992	2002	2012
Australia	2000	-	10.0	10.0
Austria	1973	20.0	20.0	20.0
Belgium	1971	19.0	21.0	21.0
Canada	1991	7.0	7.0	5.0
Chile	1975	18.0	18.0	19.0
Czech Republic	1993	-	22.0	20.0
Denmark	1967	25.0	25.0	25.0
Estonia	1991	10.0	18.0	20.0
Finland	1994	-	22.0	23.0
France	1968	18.6	19.6	19.6
Germany	1968	14.0	16.0	19.0
Greece	1987	18.0	18.0	23.0
Hungary	1988	25.0	25.0	27.0
Iceland	1990	24.5	24.5	25.0
Ireland	1972	21.0	21.0	23.0
Israel	1976	18.0	17.0	16.0
Italy	1973	19.0	20.0	21.0
Japan	1989	3.0	5.0	5.0
Korea	1977	10.0	10.0	10.0
Luxembourg	1970	15.0	15.0	15.0
Mexico	1980	10.0	15.0	16.0
Netherlands	1969	17.5	19.0	19.0
New Zealand	1986	12.5	12.5	15.0
Norway	1970	20.0	24.0	25.0
Poland	1993	-	22.0	23.0
Portugal	1986	16.0	17.0	23.0
Slovak Republic	1993	-	23.0	20.0
Slovenia	1999	-	20.0	20.0
Spain	1986	12.0	16.0	18.0
Sweden	1969	25.0	25.0	25.0
Switzerland	1995	-	7.6	8.0
Turkey	1985	10.0	18.0	18.0
United Kingdom	1973	17.5	17.5	20.0
<b>Unweighted Average</b>		<b>16.4</b>	<b>17.9</b>	<b>18.7</b>

Source: World Trade Organization (<https://www.wto.org/>) India Trade Profile, accessed on December 4, 2016

only. However, the rules should be more refined and free from ambiguity.

- The GST is a destination based tax, not the origin one. In such circumstances, it should be clearly identifiable as to where the goods are going. This shall be difficult in case of services, because it is not easy to identify where a service is provided, thus this should be properly dealt with.

- More awareness about GST and its advantages have to be made, and professionals really have to take the onus to assume this responsibility.

### CONCLUSIONS

Tax policies play an important role on the economy through their impact on both efficiency and equity. A good tax system should keep in view issues of income distribution and, at the same time, also endeavour to generate tax revenues to support government expenditure on public services and infrastructure development. There has been a good deal of criticism as well as appraisal of the proposed Goods and Services Tax regime. The implementation of GST would eventually include more agricultural production.

GST is not simply VAT plus service tax, but a major improvement over the previous system of VAT and disjointed services tax—a justified step forward. GST may usher in the possibility of a collective gain for industry, trade, agriculture and common consumers as well as for the Central Government and the State Government. Sooner or later, the GST will surely knock the doors of India. And when that happens, we as future torch bearers of the profession are required to be prepared and fully equipped with our knowledge regarding GST.

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## Implication of GST on Indian Agriculture and Agricultural Marketing

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### ABSTRACT

Agriculture is the root of the Indian economy and government has always kept it as its top priority. Good and Services Tax (GST) was envisaged to have a simple harmonized tax structure with operational ease leading to a single unified market at national level for goods and services. It is expected that after the implementation of the GST, the prices of the agricultural products will rise but the products will be able to reach places in a better way. The implementation of GST will also favor the National Agricultural Market on merging all the different taxation on agricultural products. The ease of transportation of the agricultural product will improve the marketing and virtual market growth. The underlying principle in both the initiatives is to have a national market facilitating trade and transparency.

### Key words

Agricultural marketing, agriculture, GST

### JEL Codes

H21, O13, Q13

### INTRODUCTION

India is a unique experiment in central governance with the challenge for ensuring efficient economic development without compromising independence of states. The Agriculture sector in India has enjoyed a special treatment in the current taxation regime and has been granted various tax exemptions and concessions both by the Central as well as the State Governments. Sale of Agricultural produce has been exempted from the levy of VAT. State wise exemptions from levy of VAT have been granted to commodities like Cereals, paddy, rice, wheat, pulses, fresh plants, fruits and vegetables, milk, eggs, meat, etc. Concessional rates of VAT have been levied by various states on agricultural machinery and implements, agricultural tractors, trailers and trolleys, harvesters, threshers, including attachments, components and parts thereof. Since agriculture is a state subject, Good and Services Tax (GST) was envisaged to have a simple harmonized tax structure with operational ease leading to a single unified market at national level for goods and services while ensuring that there is no negative revenue impact on the states. The fundamental concept of GST is to levy of tax at each stage of supply of goods and services along with granting of input tax credit

of the taxes paid at the earlier stage.

With the onset of GST there is a concern whether the various tax exemptions and concessions being enjoyed by the agriculture sector would continue or would be removed/reduced and thus leading to higher inflow of taxes resulting in increase in costs. Prices of agricultural commodities and services are expected to rise between 0.61 per cent and 1.18 per cent whereas the overall prices of all manufacturing sector would decline between 1.22 per cent and 2.53 per cent (The Hindu, 2013). On a similar vein, the central sector scheme on National Agricultural Market has been launched to ensure efficiency in agricultural marketing. Consequently, the terms-of-trade move in favour of agriculture vis-à-vis manufactured goods within a range of 1.8 to 3.8 per cent (NCAER, 2009). Agricultural commodities are perishable in nature in varying degrees; therefore, trade is influenced by the time required for transportation. The simple uniform tax regime is expected to improve the transportation time and curtail wastage of precious food. The present system many times, makes it difficult to implement tax support provided by the centre for agricultural products due to heterogeneous policies adopted by the different states. The implementation of GST is expected to bring

uniformity across states and centre which would make tax support policy of a particular commodity effective. The ease of availing tax credit under GST regime is expected to boost inter-state trade leading to achieving the objectives of National Agricultural Market.

The increase in agricultural prices would benefit millions of farmers in India. With regard to the food crops, the poor would continue to remain secured through the public distribution system. The prices of many other consumer goods are expected to decline. These include sugar, beverages, cotton textiles, wool, silk and synthetic fiber textiles and textile products and wearing apparel. The price increases would be beneficial for millions of farmers as they will receive higher prices for their products. Moreover this price increase will have minimum impacts on the poor as they will continue to remain secured through the Public Distribution System (PDS). The GST will contribute to economic growth and support the creation of around 20 million jobs in agricultural and non-agricultural sectors and bring down inflation (IFSP, 2016). Simultaneously, farmer associations have raised concerns that the Government may implement individual measures to control food inflation, meaning that farmers will have to pay higher prices for their inputs but not receive higher prices for their products.

#### **GOODS AND SERVICES TAX (GST)**

Goods and Services Tax would be a comprehensive indirect tax on manufacture, sale and consumption of goods and services throughout India, to replace taxes levied by the central and state governments. Goods and Services Tax would be levied and collected at each stage of sale or purchase of goods or services based on the input tax credit method. This method allows GST registered businesses to claim tax credit to the value of GST they paid on purchase of goods or services as part of their normal commercial activity. Taxable goods and services are not distinguished from one another and are taxed at a single rate in a supply chain till the goods or services reach the consumer. Administrative responsibility would generally rest with a single authority to levy tax on goods and services.

The introduction of GST would be a significant step in the reform of indirect taxation in India. Amalgamating several Central and State taxes into a single tax would mitigate cascading or double taxation, facilitating a common national market. The simplicity of the tax should lead to easier administration and enforcement. From the consumer point of view, the biggest advantage would be in terms of a reduction in the overall tax burden on goods, which is currently estimated at 25-30 per cent. The free movement of goods from one state to another without stopping at state borders for hours for payment of state tax or entry tax and reduction in paperwork to a large extent.

#### **Advantages of GST**

The uniformity in tax rates and procedures across the country will lead to various benefits for the economy and

the consumers.

1. Single National Market-the amalgamation of various taxes of central and state into one will simplify the procedure and help in evolution of a common market at national level
2. Easy administration and enforcement of tax system in country
3. Increase in tax revenue is projected due to better compliance and broader tax base
4. Increase in exports due to cost effective production and transaction of goods and services
5. The burden of tax on goods is expected to fall under GST leading to benefits to the consumers

#### **Why lagging the implementation of GST?**

The states fear to lose their power to impose and collect taxes and loss of revenue. The extended period of negotiations and deliberations helped in putting the apprehensions of states to rest on loss of revenue and losing fiscal independence. The establishment of NAM involving participation of various states is likely to face similar problems of consensus building among states on various aspects dealing with revenue and related uneasiness. The lesson learnt in reaching at consensus for implementation of GST could ease the implementation of NAM (CCS-NIAM, 2015). As the GST is being introduced with the objective of having a unified tax structure for goods and services, this is likely to facilitate and strengthen the Scheme on NAM aimed at an integrated system of market of agriculture produce at the national level, allowing free flow of agricultural commodities across states.

#### **NATIONAL AGRICULTURAL MARKET (NAM)**

National Agriculture Market (NAM) is a pan-India electronic trading portal which networks the existing APMC mandis to create a unified national market for agricultural commodities. The NAM Portal provides a single window service for all APMC related information and services. This includes commodity arrivals & prices, buy & sell trade offers, provision to respond to trade offers, among other services. While material flow (agriculture produce) continues to happen through mandis, an online market reduces transaction costs and information asymmetry.

Agriculture marketing is administered by the States as per their agri-marketing regulations, under which, the State is divided into several market areas, each of which is administered by a separate Agricultural Produce Marketing Committee (APMC) which imposes its own marketing regulation (including fees). This fragmentation of markets, even within the State, hinders free flow of agri commodities from one market area to another and multiple handling of agri-produce and multiple levels of mandi charges ends up escalating the prices for the consumers without commensurate benefit to the farmer.

NAM addresses these challenges by creating a unified market through online trading platform, both, at State and National level and promotes uniformity, streamlining of

procedures across the integrated markets, removes information asymmetry between buyers and sellers and promotes real time price discovery, based on actual demand and supply, promotes transparency in auction process, and access to a nationwide market for the farmer, with prices commensurate with quality of his produce and online payment and availability of better quality produce and at more reasonable prices to the consumer.

#### **NAM and GST**

To achieve National Market in agriculture, there is need for harmonization in the provisions of APMC Act, 2003, Essential Commodities Act, 1955 and Warehousing (Development and Regulation) Act, 2007. The implementation of GST is expected to facilitate the implementation of NAM on account of subsuming all kinds of taxes/cess on marketing of agricultural produce as well as it would ease interstate trade of agricultural commodities which would improve marketing efficiency,

facilitate development of virtual markets through warehouses and reduce overhead marketing cost.

Agricultural commodities are perishable in nature in varying degrees therefore trade is influenced by the time required for transportation. The long distance trucks in India are parked for 60 per cent of the time during transportation. The simple uniform tax regime is expected to improve the transportation time, and curtail wastage of precious food. The present system many times, makes it difficult to implement tax support provided by the centre for an agri-commodity due to heterogeneous policies adopted by the different states. The implementation of GST is expected to bring uniformity across states and centre which would make tax support policy of a particular commodity effective.

The ease of availing tax credit under GST regime is expected to boost inter-state trade leading to achieving the objectives of National Agricultural Market. The

**Table 1: Degree of market distortions**

Name of the State	Sales Tax (in percentage)	Taxes (as percent of MSP)	Remarks
Andhra Pradesh	All Commodities (except Maize,		
Bihar		3.0	
Assam	All commodities (except rice, wheat, pulm, f&v, fish, gur, atta, maida etc.)-		*Not collected as markets are not in operation
Chattisgarh		2.2	
Delhi	F & V- nil Oilseeds-3, Methi-7		
Gujarat	1.Spices-3, Aniseed- 2, Cotton -4, Isabgol-2, Cummin-2, Ajwain-2	0.8	Other agricultural commodities exempted from Sales tax
Goa	Betelnut-2,Cashewnut- 2 Coconut, F&V, Cattle & Milk exempted from Sales Tax		Octroi - 0.2 to 4 per cent Entry fee cattle – ₹10/head Vehicle- ₹10/truck
Jharkhand		1.0	
Haryana	F&V-nil, Food grains-4, Pulses-4, Oilseeds-4	11.5	
Himachal Pradesh		5.0	
Karnataka	Foodgrains-nil, Pulses -2, Oilseeds-4		Market fee exempted for industrial & export purchases.
Kerala	4 to 8		There is no market regulation and hence no prescribed charges.
Madhya Pradesh	NA	9.2	Development cess from traders only-1 to 5 per cent.
Maharashtra	All agricultural commodities are exempted from Sales Tax	3.8	Entry fee – ₹10/truck.
Punjab		14.5	
Rajasthan	F & V-nil, Foodgrains-4, Pulses & Oilseeds-2, Coarse grains--nil	3.6	Surcharge on sales tax-15 per cent
Tripura	Nil(for all agricultural commodities)		Entry fee ₹1/head
Uttar Pradesh	Foodgrains-4, Pulses-2, Oilseeds & Others- 4	16.71	
Uttarakhand		7.5	
West Bengal	NA	2.5	Purchase tax jute -4 per cent

Source: CCS-NIAM

implications of GST on agricultural marketing need further examination due to its features like business size. Even if the food is within the scope of GST, such sales would largely remain exempt due to small business registration threshold. Also, given the exemption of food from central Value Added Tax and 4 per cent Value Added Tax on food item, the GST under a single rate would lead to a doubling of tax burden on food. There is need for more clarity on exemptions available under CGST and SGST. Some of the States are imposing Purchase Tax and Development Cess on sale of agricultural produce in the markets. For example, Maharashtra, earns more than 13,000 crore annually from octroi. Gujarat, on the other hand, earns about 5,000 crore from the CST. Agrarian states such as Punjab and Haryana earn more than 2,000 crore from purchase tax. Therefore, on account of subsuming this Tax/Cess in to GST may adversely affect the income of States. Therefore, it would be necessary to compensate such states in the beginning of introduction of GST.

The terms of trade can also be expected to improve in favour of agriculture vis-avis manufactured goods. The prices of agricultural goods would increase between 0.61 percent and 1.18 percent whereas the overall prices of all manufacturing sector would decline between 1.22 percent and 2.53 percent. Consequently, the terms of trade will move in favour of agriculture between 1.9 percent and 3.8 percent. The increased agricultural prices are expected to improve terms of trade but at the retail level. There is need for an efficient agricultural marketing system ensuring the proportionate increase in the prices at the producers' level as well. The national agricultural market which coincides with the proposed reforms in taxation through GST may help in developing a system ensuring balanced distribution of the value created.

At present small scale of operations and low level of processing in agriculture may be one of the reasons limiting agricultural commodities to avail benefits of GST unlike manufactured goods. NAM is expected to help scale size of business and attract big players making the agricultural marketing reach a level to start availing benefits offered by GST. GST is predicted to reduce

incidence of suppressed sales since billing and payment of tax would be necessary for availing set-off of taxes at each stage. The same principle would apply to transactions between traders in agricultural commodities where there is substantial amount of suppressed sale.

The taxes applicable on agricultural trade in addition to the market fee also vary from state to state. The degree of market distortions on account of variation in the levy of market taxes/cess applicable on different commodities in different states are presented in Table 1.

## **CONCLUSIONS**

The execution of GST is certainly linked to successful implementation of NAM as it aims at unified tax structure of goods and services which would ultimately include agricultural produce. The NAM facilitate smooth flow of goods and services across states leading to competitive and transparent prices with chance of increased share to the farmer in the value created in agricultural commodities. The insight from the GST experience may also help in resolving various bottlenecks to be encountered in evolving a unified common agricultural market. While the GST bill is a step in the right direction, a lot more needs to be done by the states including, creating better physical infrastructure, improved price dissemination campaigns, and removing laws that force farmers to sell to local monopolies, etc.

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## Cost-Return Structure of Crop Farming on Marginal and Small Farms in Sub-Mountainous Region of Punjab

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### ABSTRACT

The present study was undertaken in sub-mountainous region of Punjab state to examine the cost-return structure of crop farming. The results of the study revealed that a large part of fixed investment was made on tractor, trolley and electric motor on the sample farms. Maize-wheat cropping system dominated while paddy was grown in limited area. Family labour was used in higher proportion as compared to hired labour. The total cost came out to be ₹82517 and ₹201136 on marginal and small farms respectively while it was ₹142040 in overall scenario. Variable cost more on small farms because higher variable inputs were used on small farms than marginal farm. Gross income from crop farming came out to be ₹74710 in case of marginal and ₹205466 on small farms. The returns over variable cost were ₹45828 and ₹125392 on marginal and small farms, respectively. Returns over total cost were negative for marginal farms. The study concluded that more training programmes should be initiated to guide the farmers about the judicious use of different inputs which can result in decline in the cost of production along with higher crop productivity.

### Keywords

Cost-return structure, crop farming, marginal and small farms

### JEL Codes

C83, D24, I38

### INTRODUCTION

Punjab is one of the most progressive states of India and is having a similar type of land distribution though little better than the Indian situation. Out of 11.7 lakh operational holdings during 1990-91, 2.04 lakh holdings (18.3 per cent) were of one to two hectare and 2.96 lakh holdings (26.5 per cent) were of less than one hectare in size. The total holdings declined to 10.52 lakh in 2010-11. As such the number of small holdings are 1.95 lakh (18.57 per cent) and that of marginal holdings to 1.64 lakh (15.62 per cent), respectively (Anonymous, 2014). On the other hand, marginal and small farmers account for nearly 80 per cent of the total operational holdings in the country, cultivating about 36 per cent of the total area. The decline in proportion of marginal and small holdings may be due to the operation of reverse tenancy and the marginal and small landowner's leasing out their land to other farm-size groups. Majority of them are dry lands and even irrigated areas depend on the vagaries of monsoon. In this context, if farmers concentrated on crop production they will be subjected to a high degree of uncertainty in income and

employment. Hence, it is imperative to evolve suitable strategy for augmenting the income of the small and marginal farmers by combining to increase the productivity and supplement the income. In an agricultural country like India, the average land holding is very small.

It is often ascertained that small farms are non-viable on their own. Even if farmers cultivate the best possible crops or combination of crops, the returns will remain meager. Thus, small farms, *per se*, are not viable unless they are supported with some supplementary income (Chandra, 2001). About 19 per cent of the marginal and small farmers in Punjab were under acute burden of indebtedness (Singh *et al.*, 2007). The deepening of economic and ecological crises and globalization of economy are likely to have large adverse impact on these farm-categories.

The agricultural productivity in the Punjab state has nearly stagnated and the consistent rise in cost of production is resulting into squeezing of profit margins (Singh & Kolar, 2001). The soil and water, the two most

crucial resources, have sharply deteriorated because of excessive use of chemicals and irrigation water for growing the same crops over and over again. The underground water table is receding at an alarming rate of 30 cm per annum (Chibba *et al.*, 2005). The falling water table is not only seriously threatening the ecological balance but also is effectively excluding marginal and small farmers from utilizing this common natural resource, leading to tension and social strife (Sidhu, 2002). The declining soil fertility and the water table will further push up cost of production and increase the already prevailing indebtedness of these farmers.

The income from cropping for an average farmer is hardly sufficient to sustain his family. The farmer has to be assured of a regular income for a reasonable standard of living by including other enterprises. In view of the above facts there is a strong need to commercialize agriculture and in order to ensure an all-round development of farming families, farming should be considered as a system in which crop and other enterprises that are compatible and complementary are combined together. To ameliorate the problems of these farmers, the various suggested options include corporatization of farming, diversification of agriculture, introduction of new generation cooperatives, contract farming, etc. (Singh, 2000). An effort is going on in this direction since 1986, when the first expert committee for diversification of agriculture was instituted, but significant results have not been achieved so far.

It has been noticed in Punjab that even with the same socio-economic environment, some of the marginal and small farmers are thriving well and are able to earn enough income to meet their actual expenditure (farm expenditure + cost of living determined by their prevailing consumption pattern and life-styles and not calculated at the normative requirement basis necessary for a dignified standard of living). There are multiple factors responsible for this viability. Broadly, the likely factors are; education level of farmers, family size, farm

size, fixed investment, off-farm income, domestic expenditure and productivity of crops.

#### MATERIAL AND METHODS

Keeping in view the objectives to be attained, two districts namely Ropar and Hoshiarpur from the 'Sub-mountainous region' of the state were selected for the present investigation. Two blocks from each district, one cluster of 3-4 villages from each village was selected randomly. After the selection of villages, a complete enumeration of all the farmers with respect to milch animals and operational holding size was carried out. All the farmers were classified into two categories viz. marginal and small on the basis of operational holding size. A sample of 100 farmers undertaking dairy farming was randomly chosen from selected villages with equal representation from marginal and small farmers category. The relevant information pertaining to investment made, input-output obtained from crop farming were collected for the year 2014-15 and then estimating the cost-return structure of crop farming.

#### RESULTS AND DISCUSSION

##### Income and employment in crop enterprises

##### Fixed investment

Table 1 shows the present value of the investment made on farm machinery and implements on sample farms. In aggregate, the present value of the investment made on farm machinery and implements was ₹51372 on marginal, ₹203139 on small and ₹127256 in an overall situation. On an average, the present value of the investment made on marginal farms was ₹21900, ₹2300, and ₹24440 on tractors, trolley and electric motor whereas on small farms the corresponding values were ₹110300, ₹18106, and ₹64400, respectively. Thus, tractor, trolley and electric motor constituted the major components of the investment made on marginal and small farms.

##### Cropping pattern

The cropping pattern on the sample farms has been shown in Table 2. A perusal of the Table 2 revealed that out of total operational holding, 50.67 per cent, 12.00 per

**Table 1: Present value of the investment made on farm machinery and implements on sample farms in Punjab (2014-15)**

Particular	No.	(Per farm)				
		Marginal farms	No.	Small farms	No.	Overall
Tractor	0.30	21900	0.70	110300	0.50	66100
Trolley	0.10	2300	0.36	18106	0.23	10203
Electric motor	0.38	24440	0.62	64400	0.50	44420
Diesel engine	0.04	360	0.22	1877	0.13	1119
Disc harrow	0.12	740	0.28	2860	0.20	1800
Cultivator	0.24	1030	0.58	3770	0.41	2400
Leveller	0.12	284	0.14	540	0.13	412
Ridger	-	-	0.06	200	0.03	100
Spray pump	0.08	48	0.26	296	0.17	172
Planker	0.12	270	0.34	790	0.23	530
Total	-	51372	-	203139	-	127256

**Table 2: Cropping pattern on the sample farms in Punjab (2014-15)**

Crop	(Ha/farm)		
	Marginal farms	Small farms	Overall
<b>Kharif season</b>			
Maize	0.38	0.88	0.63
Paddy	0.09	0.32	0.21
Fodder	0.23	0.26	0.24
Other crops	0.05	0.10	0.07
Total	0.75	1.56	1.15
<b>Rabi season</b>			
Wheat	0.55	1.31	0.93
Fodder	0.20	0.23	0.21
Other crops	-	0.02	0.01
Total	0.75	1.56	1.15

cent, 30.67 per cent and 6.66 per cent area was under maize, paddy, fodder and other crops on marginal farms while on small farms the corresponding relative share was 56.41 per cent, 20.51 per cent, 16.67 per cent and 6.41 per cent, respectively. Area allotted was more for maize by both marginal and small farmers. During rabi season, wheat crop dominated the cropping pattern with 73.33 per cent and 83.97 per cent of operational area in case of both marginal and small farms. These results are similar with the findings of Kaur *et al.* (2011) and Singh and Joshi (2008) who also found that wheat dominated the cropping pattern in case of both marginal and small farms.

#### Human labour

Table 3 represents the human labour employment in crop enterprise. The total man days per annum used in crop farming on marginal and small farms were 76.31 and 171.7 respectively.

**Table 3: Human labour employment in crop enterprise on sample farms in Punjab (2014-15)**

Human labour	(Average man days/annum)		
	Marginal farms	Small farms	Overall
Family labour	72.99	133.44	105.14
Hired labour	3.32	38.26	16.65
Total	76.31	171.7	121.79

Family labour was used in higher proportion as compared to hired labour on both marginal and small farms and it was 72.99 days and 133.44 man days respectively. On small farms higher hired labour was used as compared to marginal farms and it was 38.26 man days and 3.32 man days, respectively. These results are consistent with the findings of Sharma and Garg (2013).

#### Variable cost

Table 4 represents the total variable cost incurred in crop farming on the sample farms. The total variable cost on crop farming during both kharif and rabi season was ₹28246 per annum and ₹78312 per annum for marginal

**Table 4: Variable cost incurred on sample farms in Punjab (2014-15)**

Crop	(₹/farm)		
	Marginal farms	Small farms	Overall
<b>Kharif season</b>			
Maize	6504	22400	14452
Paddy	1567	7035	4301
Fodder	2149	2455	2302
Other crops	281	5041	2661
<b>Rabi season</b>			
Wheat	14463	36708	25586
Fodder	3282	4380	3831
Other crops	-	293	147
Total	28246	78312	53280

*Other crops include Pumpkin, Mustard, Sesamum, Moong etc.*

and small farms.

#### Kharif season

The cost incurred on maize crop was more (₹6504) on marginal farms because more area was under this crop followed by fodder (₹2149) and paddy (₹1567). The cost incurred on raising other crops was just ₹281 per farm which was much less as compared to maize and fodder because of less area under these crops. In case of small farms, cost incurred on raising maize was more (₹22400) because of more area allotted to this crop followed by paddy (₹7035), other crops (₹5041) and fodder (₹2455).

#### Rabi season

The analysis revealed that the major cost incurred in rabi season was on raising wheat for both marginal and small farms and it was of ₹14463 and ₹36708 on marginal and small farms. Other crops were grown only by small farmers in rabi season.

#### Gross return

Table 5 depicts the gross returns from both main and by-product in crop farming on the sample farms. The total gross returns from both main product and by-product were ₹74710 and ₹205466 on marginal and small farms while it was ₹140089 in an overall scenario.

#### Kharif season

In kharif season, the returns in case of marginal farms were more from maize crop in the order of ₹13029 due to higher area under this crop followed by paddy (₹7853), fodder (₹4305) and other crops (₹2138). On small farms, the total returns from maize were higher (₹42840) than paddy (₹30677), other crops (₹20692) and fodder (₹4471).

#### Rabi season

A perusal of the Table 5 revealed that the gross returns were more from wheat on both marginal and small farms and it was in the order of ₹33034 and ₹89938 respectively followed by fodder. Other crops were grown on small farms during rabi season with gross returns of ₹2051 per

**Table 5: Gross return from both main and by-product in crop farming on sample farms in Punjab (2014-15)**

Crop	(₹/farm)		
	Marginal farms	Small farms	Overall
<b>Kharif season</b>			
Maize	13029	42840	27935
Paddy	7853	30677	19265
Fodder	4305	4471	4388
Other crops	2138	20692	11415
<b>Rabi season</b>			
Wheat	33034	89938	61486
Fodder	14351	14797	14574
Other crops	-	2051	1026
Total	74710	205466	140089

*Other crops include Sugarcane, Pumpkin, Mustard, Sesamum, Moon, etc.*

farm. Thus, wheat, maize and paddy were the major crops constituting nearly 78 per cent of the gross returns in an overall scenario on sample farms.

#### Returns over variable cost

Table 6 represents returns over variable cost (ROVC) from crop farming. The returns over variable cost during both kharif and rabi season were ₹46464 per annum and ₹127154 per annum respectively on marginal and small farms.

#### Kharif season

The returns over variable cost were more from maize crop (₹6525) on marginal farms followed by paddy (₹6286), fodder (₹2156) and other crops (₹1857). In case of small farms, it was more on paddy (₹23642) followed by maize (₹20440), other crops (₹15651) and fodder (₹2016).

#### Rabi season

**Table 6: Return over variable cost from crop farming on sample farms in Punjab (2014-15)**

Crop	(₹/farm)		
	Marginal farms	Small farms	Overall
<b>Kharif season</b>			
Maize	6525	20440	13483
Paddy	6286	23642	14964
Fodder	2156	2016	2086
Other crops	1857	15651	8754
<b>Rabi season</b>			
Wheat	18571	53230	35900
Fodder	11069	10417	10743
Other crops	-	1758	879
Total	46464	127154	86809

*Other crops include pumpkin, mustard, sesamum, moong, etc.*

It can also be seen from the Table 6 that in rabi season the returns over variable cost were higher from wheat on both marginal and small farms and it was to the order of ₹18571 and ₹53230 respectively followed by fodder which were ₹11069 on marginal and ₹10417 on small farms. Other crops were grown on small farms in rabi season with returns of ₹1758 per farm.

#### Cost-return structure

Table 7 represents the total cost-return structure of crop enterprise on marginal and small farms. The total cost came out to be ₹82517 and ₹201136 on marginal and small farms respectively while it was ₹142040 in overall scenario. The variable cost incurred by using various farm inputs comes out to be ₹28246 on marginal farms and ₹78312 on small farms. Interest on variable cost was ₹636 on marginal and ₹1762 on small farms for half period of crop season. The total variable was more for small farms

**Table 7: Total cost-return structure of crop farming on the sample farms in Punjab (2014-15)**

Particular	(₹/farm)		
	Marginal farms	Small farms	Overall
1 i Variable Cost	28246	78312	53280
ii Interest value @ 9per cent p.a. for half period of crop season	636	1762	1199
A Total variable Cost	28882	80074	54479
2 i Interest on fixed investment @ 9per cent p.a.	4623	18283	11453
ii Depreciation on equipment @ 5per cent p.a.	2569	10157	6363
iii Rental value of owned land & leased in land	28195	59262	43460
B Total fixed cost	35387	87702	61276
3 i Imputed value of family labour	18248	33360	26285
Total Cost ( A+B +Family labour)	82517	201136	142040
Gross return	74710	205466	140089
Return over variable cost	45828	125392	85610
Return over total cost	-7807	4330	-1951
Gross returns per hectare	99613	131709	121817

as compared to marginal farms and it was in the order of ₹80074 and ₹28882, respectively. This was because of the fact that higher variable inputs were used on small farms. These results are similar with the findings of Kaur *et al.* (2001) who also reported that cost incurred by small farms was more as compared to marginal farms.

Interest on fixed investment was ₹4623 and ₹18283 on marginal and small farms while depreciation on equipment was ₹2569 and ₹10157 on marginal and small farms. Rental value of owned land and leased in land was ₹28195 and ₹59262 on marginal and small farms, respectively. Total fixed cost was more on small farms (₹87702) as compared to marginal farms (₹35387) since farmers on small farms owned higher operational holding and farm machinery.

Gross income from crop farming came out to be ₹74710 in case of marginal and ₹205466 on small farms. The returns over variable cost were ₹45828 and ₹125392 on marginal and small farms, respectively. Returns over total cost were negative for marginal farms because the yield of crops was much less on the sample marginal farms. In the case of small farms, returns over total cost were ₹4330 per farm.

#### **CONCLUSIONS AND POLICY ISSUES**

A large part of fixed investment was made on tractor, trolley and electric motor on the sample farms. In kharif season, major crop grown was maize and in rabi season wheat crop dominated the cropping pattern on the sample farms. Family labour was used in higher proportion as compared to hired labour on both marginal and small farms for crop production. The return over variable cost per hectare from crop production was more on small farms as compared to marginal farms. More training

programmes should be initiated to guide the farmers about the judicious use of different inputs which can result in decline in the cost of production along with higher crop productivity.

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## Levels, Pattern and Distribution of Income among Marginal and Small Farmers in Rural Areas of Haryana

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### ABSTRACT

*The objective of the present paper is to analyze the levels, pattern and distribution of income among marginal and small farmers in rural areas of Haryana. The study has concluded that average household income and per capita income is directly related with the agricultural productivity and farm-size. The top 10 per cent earned 10 times more income than the bottom 10 per cent. The marginal and small farmers try to maintain a minimum level of consumption whether they can afford it or not. To overcome this problem, income of the farmers needs to be increased through different measures.*

### Keywords

Distribution, income, marginal and small farmers

### JEL Codes

D31, P25, Q12, Q15

### INTRODUCTION

The development of agriculture sector lays the strong base for steady economic growth of our country which clearly indicates that agriculture is the most important component of the development process in the rural areas. Agriculture remains as the perennial source of livelihood and also provides raw materials to a very large number of industries (Alexpandi & Kumar, 2014). Although, the share of agriculture in Gross Domestic Product (GDP) has declined from over half at the time of independence to less than one-fifth currently, but agriculture still remain the predominant sector in terms of employment (Singh & Singh, 2012), and a majority of rural families are dependent on agriculture for their livelihood. However, due to fast depletion of natural resources, sub-division of landholdings and fluctuations in climatic conditions, the income from agriculture has been dwindling (Nandini & Kiresur, 2013).

The Green Revolution technology has helped in increasing the income levels as well as total food grain production.

The state of Haryana occupies a special place in India. Haryana has become the second highest contributor of food-grains to the central pool and the state has

contributed about 15.6 per cent of food-grains to the central pool despite of a very less area of 1.4 per cent of the country. The contribution of the state in the National Gross Domestic Product at constant (2011-12) prices has been estimated to be 3.5 per cent as per the Quick Estimates of (2014-15). (GoH, 2015-16). As such Haryana has made tremendous progress in agriculture sector as it has turned from food deficit to surplus and has become one of the major contributors to Central Pool. But New Agriculture Technology may be scale neutral. It is also capital intensive (Vatta & Sidhu, 2007), and it also widens the income inequality among the different sections of farming population and provides proportionately large benefits to the big farmers as compared to the small farmers, because the small farmers are unable to make heavy investment for better irrigation facilities, seeds, fertilizers and machinery (Chowdhary, 1970). This process of transformation of Indian agriculture from a traditional to a modern state has brought in its wake new opportunities for investment in agriculture because of the high rate of return to such investment. While ushering in rapid agricultural growth the green revolution has given rise to problems arising out of the distribution of its benefits. One of its consequences

is reckoned in the form of growing disparities in farm incomes over time (Saini, 1976). It is realized that the small farmers are lagging behind the medium and large farmers in adopting modern innovations in their farming (Rao, 1975). The introduction of the New Agriculture technology would therefore result in a growing polarization between large-scale and small-scale cultivators. The small and marginal cultivators, along with agricultural labourers are the hardest hit by price fluctuations dictated by global capital.

The low and middle income groups have to resort borrowings to meet their consumption expenditure. The low income group spends a major proportion of their income on food grains whereas the higher income group spends proportionately less on food grains (Galgalikar *et al.*, 1970). Food being the foremost basic need gets the priority in the pattern of expenditure of people especially poor class (Nasurudeen *et al.*, 2006). The rising prices have adversely affected food consumption of the poor, endangering their food security. All these developments have made survival even more precarious for the rural poor households (Wilson, 2002).

Subsequently, since the mid-nineties, there has been stagnation in agricultural production resulting in food and nutritional insecurity and less gains of the farmers (Hegde, 2013). Due to the poor performance, agriculture sector has continued to be a cause of concern. Facing heavy losses and rising level of debt, the farmers committed suicides, not only in underdeveloped states, but also in developed states like Punjab and Haryana. The phenomena of suicides of poor farmers has been observed in various states of India especially where agriculture is highly commercialized. This extreme step of committing suicides was mainly noticed in the case of marginal and small farmers.

## METHODOLOGY

For the purpose of the present study, one village has been selected from each development block of the district on random basis. A representative proportional sample of the marginal and small farmers has been taken for the survey. As many as 20 per cent households out of total households are selected for survey on random basis. As a result total 554 households have been surveyed. Out of 554 households, 235 households from Mahendragarh district, 143 households from Panipat district, and 176 households from Fatehabad district were selected for the survey. Out of total households, 257 households were from the marginal farm-size category and 297 households from the small farm-size category. The study is related to the year 2014-15.

## RESULTS AND DISCUSSION

The mean values of income earned from different sources by the marginal and small farm-size categories are given in Table 1. The table reveals that an average farming household earns ₹66875.17 annually in the rural Haryana. However, there are considerable variations in the household income earned by the marginal and small farm-size categories. It is ₹56186.19 and ₹76124.55 for the marginal and small farm-size categories respectively. A positive relationship between farm-size and levels of income can be observed from the table. It is evident that as the farm-size increases, the average income of the farm households also increases. The annual income of an average small farm household is found to be 1.36 times the annual income of the marginal farm household. By virtue of being farmers, farm business income is the most important component of the household income followed by income from milk and milk products, salaries, pensions.

The average income from these four sources is found

**Table 1: Levels of income of marginal and small farmers category-wise**

(Mean values, in ₹, Per annum)

Sources of income	Marginal farmers	Small farmers	All Sampled farmers
Farm business income	42961.09	62717.17	53552.34
Milk and milk products*	5176.26	5337.37	5262.63
Poultry*	-	188.55	101.08
Livestock	1201.17	730.64	948.92
Hiring out agricultural machinery and equipments	284.05	737.37	527.08
Hiring out labour in agriculture	1610.89	639.73	1090.25
Leased out land	122.57	269.36	201.26
Sale of seeds/manure	89.49	136.36	114.62
Sale of irrigation water	66.15	81.48	74.37
Salaries	1750.97	2390.57	2093.86
Pensions	1821.01	1939.39	1884.47
Remittances	138.13	182.15	161.73
Other sources**	964.41	774.41	862.55
<b>Total</b>	<b>56186.19</b>	<b>76124.55</b>	<b>66875.17</b>

Source: Field Survey, 2014-15; \* Net Income is Taken

\*\*It includes income from hiring out labour in non-agricultural sector and income from small businesslike shop keeping.

to be Rs. 53552.34, Rs. 5262.63, Rs. 2093.86, and Rs. 1884.47 respectively. Income from milk and milk products is the highest (Rs. 5337.37) in the case of small farm-size category followed by the marginal farm-size category which accounts Rs. 5176.26.

Income from salaries is the highest in the case of small farm-size category, i.e. Rs. 2390.57 followed by the marginal farm-size category (Rs. 1750.97). Income from pension is Rs. 1821.01 and Rs. 1939.39 respectively for the marginal and small farm-size categories. Income from hiring out labour in agriculture shows a negative relationship with farm-size. As the farm size increases the income from hiring out labour in agriculture decreases. The marginal farm-size category earns an income of Rs. 1610.89 from this source and the small farm-size category earns Rs. 639.73. Income from the sale of irrigation water, seed/manure, leasing out land, hiring out agricultural machinery and equipments, remittances shows a positive relationship with farm-size. The analysis clearly indicates that farm business income of the marginal and small farm-size categories is not sufficient and farmers of these categories are compelled to hire out labour in agriculture sector to supplement their income.

**Pattern of Income**

The relative shares of income from various sources of farm households are given in Table 2. The table shows that the main source of income in the case of an average sampled farm household is the farm business income.

On an average, 79.71 per cent of the total income consists of farm business income. This proportional share is positively associated with farm-size. The marginal and small farm-size categories received 76.46 per cent and 82.52 per cent of their average annual household income from farm business respectively.

The second important source of income in the case of an average sampled farm household is income from milk and milk products. Slightly more than 8 per cent of the total income consists of income from this source. The percentage share of income from this source stands at 9.21 for the marginal farm-size category and 7.01 per cent for the small farm-size category. The relative share of income from this source shows a negative relationship with farm-size. Income from salaries ranks third in the case of an average sampled farm household. The relative share for this source of income is 3.13 per cent for an average sampled farm household. It is 3.12 per cent for the marginal farm-size category and 3.13 per cent for the small farm-size category. The fourth place in the income pattern of all farm-size categories goes to the income from pensions. An average sampled farm household earns 2.85 per cent of the total income from this source. The relative share of this source in the total household income is 3.24 per cent and 2.52 per cent for the marginal and small farm-size categories respectively. The relative share of income from pensions shows a negative relationship with farm-size.

The next important source of income is hiring out

**Table 2: Pattern of income of marginal and small farmers: Category-wise**  
(Percentage of total income)

Source of income	Marginal farmers	Small farmers	All sampled farmers
Farm business income	76.46	82.52	79.71
Milk and milk products*	9.21	7.01	8.03
Poultry*	-	0.24	0.13
Livestock	2.13	0.94	1.49
Hiring out agricultural machinery and equipments	0.50	0.96	0.75
Hiring out labour in agriculture	2.87	0.84	1.78
Leased out land	0.22	0.34	0.28
Sale of seeds/manure	0.16	0.16	0.16
Sale of irrigation water	0.12	0.10	0.11
Salaries	3.12	3.13	3.13
Pensions	3.24	2.52	2.85
Remittances	0.25	0.23	0.24
Other sources	1.72	1.01	1.34
<b>Total</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>

Source: Calculated from Table 3.1

labour in agriculture. The proportional share from this source is 1.78 per cent for an average sampled farm household. The marginal and small farm-size categories earn 2.87 per cent and 0.84 per cent respectively from this source. Hiring out labour in agriculture has a negative relationship with the farm-size.

Income from livestock appears in the sixth rank. An average sampled farm household earns 1.49 per cent of total income from this source. The relative share of this source in the total household income is 2.13 per cent and 0.94 per cent for the marginal and the small farm-size categories respectively. Income from other sources contributes 1.34 per cent to the total income for an average sampled farm household. It decreases with an increase in farm-size. The marginal and the small farm-size categories earn a very small part of income from hiring out agricultural machinery and equipments, remittances, sale of seeds/manure, poultry and sale of irrigation water.

**Per Capita Income**

In the foregoing discussion, we have analysed the income levels and income pattern of the marginal and small farm-size categories in rural Haryana. The family-size of an average sampled household is 4.88. However, there are differences in the family-size across the different farm-size categories. The average family-size is 4.81 and 4.94 for the marginal and small farm-size categories respectively. Due to differences in family-size across the different farm-size categories, it becomes relevant to look

into the per capita income levels of the marginal and small farm-size categories.

The information about the per capita income of the marginal and small farm-size categories is given in Table 3. An average sampled farm household earns per capita income of Rs. 13703.92 annually. However, there are differences in the per capita income levels of the marginal and small farm-size categories. For example, per capita income of the marginal farm-size category is Rs. 11681.12 and it is Rs. 15409.82 annually for the small farm-size category. The per capita income the small farm-size category is 1.32 times the per capita income of the marginal farm-size category. Farm business income is the most important component of per capita income followed by milk and milk products, salaries, pensions. The table reveals that the different sources of income show a similar pattern. The per capita income earned from all these sources increases with an increases in farm-size except livestock, hiring out labour in agriculture and other sources.

**Table 3: Per capita income of marginal and small farmers: Category-wise**

Source of income	Marginal farmers	Small farmers	All sampled
Farm business income	8931.62	12695.78	10973.84
Milk and milk products*	1076.15	1080.44	1078.41
Poultry*	-	38.17	20.71
Livestock	249.72	147.90	194.45
Hiring out agricultural machinery and equipments	59.05	149.27	108.01
Hiring out labour in agriculture	334.90	129.5	223.41
Leased out land	25.48	54.53	41.24
Sale of seeds/manure	18.60	27.60	23.49
Sale of irrigation water	13.75	16.49	15.24
Salaries	364.03	483.92	429.07
Pensions	378.59	392.59	386.16
Remittances	28.72	36.87	33.14
Other sources	200.50	156.76	176.75
Total	11681.12	15409.82	13703.92

Source: Calculated from Table 1

Per capita income from livestock and hiring out labour in agriculture and other sources shows a negative relationship with farm-size. As the farm-size increases per capita income from these sources decrease. Although the family size increased with an increase in the farm-size, yet the per capita income is also positively associated with farm-size.

#### **Distribution of Income**

The pattern of distribution of income among families and population of the marginal and small farm-size

categories as well as both the categories taken together as a whole have been worked out by taking cumulative percentages of per household and per capita income for each docile group after arranging the same in ascending order. Gini ratios have also been calculated to justify the pattern of distribution. Gini ratio conveys better distribution if it is nearer to zero and worse distribution if the same is nearer to unity.

#### **Household Income Distribution**

Distribution of income among the marginal and the small farm-size categories in the rural areas of Haryana has been shown in Table 4. The bottom 10 per cent farm households share only 2.64 per cent of the total income earned by all the sampled farm households.

**Table 4: Distribution of household income among farmers: Category-wise**

Cumulative percentage of households	Cumulative percentage of household income of		
	Marginal farmers	Small farmers	All sampled farmers
10	3.96	5.59	2.64
20	8.81	12.10	7.73
30	15.07	19.45	13.95
40	21.80	27.23	21.33
50	29.71	35.79	29.50
60	38.54	44.61	38.47
70	49.16	54.62	48.73
80	62.37	65.91	59.95
90	77.42	78.90	72.51
100	100	100	100
Gini coefficient	0.28	0.21	0.31

Source: Field Survey, 2014-15

On the other hand, the top 10 per cent farm households appropriate 27.49 per cent of the total income of all the sampled farm households. This is about 10 times the income shared by the bottom 10 per cent farm households. A clear contrast is obvious from the fact that the bottom 40 per cent farm households accounts for 21.33 per cent of the total income whereas only 10 per cent top households account for 27.49 per cent of the total income earned by all the sampled farm households.

The marginal and small farm-size categories also present the similar position. The bottom 10 per cent of the marginal farm households' claim 3.96 per cent of the total household income, the corresponding figure for the small farm households stands at 5.59 per cent. On the other hand, the top 10 per cent households appropriate 23.58 per cent and 21.10 per cent for the marginal and the small farm-size categories respectively. This shows that the income concentration among the marginal households is greater than that of the small farm households. Gini

coefficient also supports this evidence. These are 0.28 and 0.21 for the marginal and small farm-size respectively. Gini coefficient for all the farm households is of the order of 0.31 indicating a highly skewed distribution of income.

**Distribution of Per Capita Income**

The distribution of per capita income among the marginal and small farm-size categories is given in Table 5.

**Table 5: Distribution of per capita income among farmers: Category-wise**

Cumulative percentage of households	Cumulative percentage of household income of		
	Marginal farmers	Small farmers	All sampled farmers
10	3.77	5.31	2.35
20	8.55	11.39	7.15
30	14.38	17.98	13.01
40	21.11	25.22	19.59
50	29.10	32.97	26.88
60	38.11	41.55	35.00
70	48.18	50.92	44.35
80	60.91	62.02	55.27
90	77.10	76.05	69.64
100	100	100	100
Gini coefficient	0.29	0.25	0.35

Source: Field Survey, 2014-15

On an average, the bottom 10 per cent farmers share only 2.35 per cent of the total per capita income of all farm households, but the top 10 per cent share 30.36 per cent of the total per capita income. The bottom 10 per cent of the marginal farmers and small farmers claim only 3.77 per cent and 5.31 per cent respectively in the total income. On the other hand, the top 10 per cent of the marginal and small farmers appropriate 22.90 per cent and 23.95 per cent respectively. The values of Gini Coefficient for the per capita income for the marginal and small farm-size categories are 0.29 and 0.25 respectively. It is 0.35 for all the sampled farm households.

**CONCLUSIONS AND POLICY IMPLICATIONS**

It is concluded from the above analysis that there is a positive relationship between farm-size and income level, i.e., as the farm-size increases, the average income of the sampled farm households also increases. The field survey revealed the fact that in the rural areas of Haryana state the marginal and small farmers try to maintain a minimum level of consumption whether they can afford it or not. To overcome this problem, income of the marginal and small farmers needs to be increased through different measures. Since there is a positive relationship between farm-size and farm business income, this makes a strong case for land

reforms favour of the marginal and small farmers apart from other measures helpful in increasing their income. Educating marginal and small farmers about the subsidiary occupation, providing loans either interest free or at low rates of interest, creating sufficient employment opportunities, fixation of prices of agricultural commodities at reasonable level, assured purchase of agriculture produce, subsidizing the agriculture inputs, providing insurance cover in agriculture, establishing agro-based industries to be run through producer's co-operatives in the rural areas, reducing the unproductive expenditure on marriages and other socio-religious ceremonies, intoxicants, drugs and so on and enforcing the already existing special programmes for the rural development in proper perspective take on priority basis can help in enhancing the income of the marginal small farmers.

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## **Impact of Self-help Groups in Enhancing Farm Women Income**

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### **ABSTRACT**

*The study focussed on the economic, social and managerial impacts of self help groups in enhancing income. The study was conducted in three cultural zones of Punjab. A sample of 200 members of self help groups belonging to these zones were the respondents of the study. An interview schedule was used to document the impact of self help groups. The findings of the study revealed that women who never used to step outside the four walls of their home became business women and started supplementing their family income. The economic benefits gained from enrolling in the groups were received higher price of their products instead of selling individually (91 per cent) and understood banking operations to avail credit facility (81.50 per cent). A large number of women in Punjab developed courage to think independently (99.50 per cent), understood group activities (96 per cent) and managed group activities (95.50 per cent) after joining the group. Furthermore the social empowerment of the members in terms of team spirit (97 per cent), talking freely within family (94 per cent), and confidence in dealing with people (95.50 per cent) were enhanced. It indicates that self help groups bring economic upliftment, leadership skills in managing the group and inculcate great confidence in the members of selected groups to succeed in their day to day life.*

### **Keywords**

Economic and managerial empowerment, impact, self help groups, social

### **JEL Codes**

E21, G21, G23, L31

### **INTRODUCTION**

Punjab, a small state in the northern part of India, makes up 1.5 per cent of the country's geographical area, produces an important portion of India's food grain and contributes a major share of the wheat and rice stock held by the Central Pool. Punjab state has earned the name "Food Basket of country" and "Granary of India". It leads the other states by contributing 61 per cent of wheat and 30 per cent of rice. Punjab state has been awarded "National productivity Award for Agriculture Extension services for consecutive 10 years from 1990-91 to 1999-2000. Although there was unprecedented increase in production, yet, for a decade, the yield of major crops has been stagnant. In recent years, a drop in productivity has been observed mainly due to falling fertility of the soil and excessive use of fertilizers and pesticides, rapidly falling water table (Bhardwaj, 2014).

Of Punjab's total population, 62.5 per cent live in rural areas and most (70 per cent) are small-scale farmers owning less than 2 ha of land. As with the rest of the country, farms in Punjab are getting smaller, mainly due

to expansion of towns and cities; industrial development; the breakup of larger traditional family structures into smaller nuclear families, with an associated redistribution of land into smaller parcels (Anonymous, 2009). Moreover villages faced with problems related to poverty, illiteracy, lack of skills and poor health etc. These are problems that cannot be tackled individually but can be better solved through group efforts. Farmer organizations or self-help groups can play an important role in maximizing productivity and profitability, as well as underpinning the longer term social and ecological sustainability of farming. These groups can play a significant role in many core aspects of farming, such as increasing production at a reduced cost; providing expert technical guidance; purchasing inputs; marketing products; training; credit or equipment; representing members' interests; building influence, fundraising and carrying different projects.

NABARD has been supporting the SHG-Bank linkage programme since 1992. In the context of growing demand for micro finance by self help groups, RBI made

linkage of self help groups with banks as a priority sector activity in 1996. The government of India has been supporting the programme by making special budgetary provision for promotion of self help groups since 1999. Micro finance sector is growing vastly in India. At present, the sector provides around seven per cent of the aggregate rural credit. During 2001-02, the aggregate rural credit amounted to ₹544310 million and the credit disbursed through self-help groups was ₹4810 million which accounted just 0.88 per cent of the aggregate rural credit the year 2001-02. Comparatively, the aggregate rural credit and micro credit through SHGs amounted to ₹8406430 million and ₹515460 million respectively during 2014-15, posting net growth by 1444.42 and 10616.42 per cent in respective credit figures. However, the share of credit provision through self-help groups was less than 8 per cent of the aggregate rural credit during 2001-02 to 2014-15 (Table 1).

**Table 1: Share of SHG credit in aggregate rural credit**  
(₹ million)

Year	Rural credit disbursed by the banks	Credit disbursed through SHGs	Per cent share (Col.2/1)
2001-02	544310	4810	0.88
2002-03	695600	10260	1.47
2003-04	869810	20490	2.35
2004-05	1253090	39040	3.11
2005-06	1804860	68960	3.82
2006-07	2294000	113980	4.97
2007-08	2546570	180810	7.10
2008-09	2924370	226800	7.75
2009-10	3845140	280380	7.29
2010-11	4467790	312210	6.99
2011-12	5110290	363400	7.11
2012-13	6073750	393750	6.48
2013-14	7116210	429270	6.03
2014-15	8406430	515460	6.13

Source: Economic surveys of India and NABARD reports, 20014-15

In a study conducted by Lokhande (2013), it was found that on an average, the monthly saving amount before joining the group was ₹75.38 per respondent which rose to ₹132.87 per respondent after joining the group. It was interesting to note that 78.57 per cent respondents had used borrowed funds for the intended purpose i.e. for income generating activities whereas 21.43 per cent had used funds for other purposes such as marriages, housing repairs, repayment of old debt and other purposes. It was noteworthy that after joining the groups, more than 80 per cent of the respondents felt respected by family members and others and 60.39 per cent of the respondents expressed the feeling of security due to financial and social support extended by joining the groups while Kumari *et al.* (2013) reported that self help groups also

increased self confidence and covered risk bearing capacity (62.50 per cent) and intensified the desire to earn and make better living (58.33 per cent). Keeping into consideration the importance of self-help groups in enhancing income of women, the present investigation was undertaken.

#### MATERIALS AND METHODS

The study was conducted in Punjab. The selection of self help groups was made after procuring a list of women self help groups operating in different parts of Punjab from different sources viz. regional office of National Bank for Agriculture and Rural Development (NABARD) Chandigarh, regional office MILKFED Chandigarh and self-help groups formed under Agricultural Technology Management Agency (ATMA).

Multi stage sampling design was used for selection of respondents. At first stage, three cultural zones namely, *Majha*, *Malwa* and *Doaba* were selected. At the second stage, 2 districts from each cultural zone viz., Pathankot and Amritsar (*Majha*), Jalandhar and Hoshiarpur (*Doaba*), Moga and Ludhiana (*Malwa*) were selected randomly. At the third stage, from these 6 selected districts, 12 functional women self help groups were selected by using probability proportion to number (PPS) of self help groups in each district.

A sample of 200 women belonging to the selected self-help groups namely Mian Mamli (20), Nari Shakti (15), Amar Das (18), Guru Ram Das (14), MahaLaxmi (15), Durga (15), Chetna (15), Sada Shiv Modern (30), Assal (15), Veer Honey (14), Baba Budha (16) and Bibi Rajni (13) were selected by using probability proportion to number (PPS) of members in each group. The data were collected with the help of interview schedule. In depth study was undertaken to determine impact of self help groups.

#### RESULTS AND DISCUSSION

##### Economic impact on women self help groups

An overview of the monthly income revealed that overall as many as sixty one per cent members of the three cultural zones of Punjab increased their income in the range of ₹1000-1500 per month before and after joining the groups. This might be due to the fact that all the groups were functional and grown up enough for applying continuous efforts to organise various entrepreneurial activities. These groups initiated the development projects to get grants from the government.

As regards to the mobilization of financial resources, savings has been given importance by all the groups of *Majha*, *Malwa* and *Doaba* regions. It can be noted from the data given in Table 2 that there was increase in monthly savings before and after joining the group. As many as eighty two per cent of members had increased monthly savings to the tune of ₹50-₹100 while nearly 60 per cent of members in all the groups had increased monthly savings to the tune of ₹100-200. The results of the study pointed out that the incremental income not only enhanced the productive expenditure of family but also

promoted the savings. The findings were supported by Sharma and Varma (2008).

It can be noted from the data given in Table 3 that monthly income and savings of members of self help groups before and after joining the group belonging to *Majha*, *Malwa* and *Doaba* region were found to be significant at one per cent level. It indicates that members of all the groups significantly increased their income as well as savings after joining the group. It is due to the fact that the group members were actively involved in various economic projects such as candle making, processing of fruits and preparation of pickles, squashes and vermicelli. The findings were in line with the studies conducted by various researchers on impact of self help groups (Tita et al., 2011; Reddy & Reddy, 2012; Kondal, 2014).

The data in Table 4 further reported that a large majority (91 per cent) of the members of self help groups of three zones received higher price of their products instead of selling individually while major portion (81.50 per cent) had developed ability to understand banking operations after joining the group. It is remarkable to report that members of Sada Shiv Modern (*Doaba*) had contributed money in purchasing mobile phone (3.75 per cent) and AC (1.25 per cent). It indicates that now-a-days women working in the SHGs are also respected by the family as they are independent in earning the income and contributing to family income, expenditure and savings. As a result of which family got economically empowered. The findings of Bera (2011) found that the family

expenditure has increased due to positive change in the self help group member's income.

It is further depicted from the data in Table 4 that two-third members of *Malwa* region had increased the use of milk intake and could spare time for teaching child at home instead of sending to tuition as compared to *Majha* (42 per cent) and *Doaba* (44 per cent).

#### Managerial impact on women in selected self help groups

Managing the group is a special art, important for effective working of the groups. Managerial empowerment of members of self help groups is presented in Table 5. For measuring managerial empowerment, various aspects were studied. Based on the opinion given by the selected members of self help groups, the data indicated that very high percentage of the members of all the groups of three zones developed courage to think and act independently (99.50 per cent), understood group goal (96 per cent), realized their potentials (95.50 per cent), managed various activities of groups such as acquiring finance, indentifying raw materials, marketing the produce (95.50 per cent) and enhanced the ability to take risk (93.50 per cent). It shows that all these groups were actively involved in management process and were responsible for different activities of the group. It is further indicated that large majority of the members (90 per cent) of *Doaba* region properly utilized their time and resources for managing the group as compared to *Majha* (75.80 per cent) and *Malwa* (79.31 per cent).

**Table 2: Income generation and monthly savings of women of selected self help groups**

Increase in monthly income (₹/month)	Majha (n <sub>1</sub> =62)		Malwa (n <sub>2</sub> =58)		Doaba (n <sub>3</sub> =80)		Overall (N=200)	
	f	Per cent	f	Per cent	f	Per cent	f	Per cent
500-1000	8	12.90	9	15.51	16	20.00	33	16.50
1000-1500	39	62.90	37	63.79	47	58.75	123	61.50
1500-2000	15	24.19	10	17.24	16	20.00	41	20.50
2000-2500	-	-	2	3.44	1	1.25	3	1.50
<b>Increase in monthly savings (₹/month)</b>								
50-100	25	40.32	20	34.48	33	41.25	78	39.00
100-150	27	43.54	26	44.82	33	41.25	86	43.00
150-200	10	16.12	10	17.24	13	16.25	33	16.50
200-250			2	3.44	1	1.25	3	1.50

**Table 3: Monthly income and monthly savings of women of selected self help groups before and after joining the group**

Region	Monthly income				Monthly savings			
	Before	After	Mean difference	t-statistics	Before	After	Mean difference	t-statistics
Majha	1375	2681.45	1306.45	14.75*	85	197.90	112.90	12.65*
Malwa	1285	2578.10	1293.10	12.35*	70	189.83	119.83	14.75*
Doaba	1390	2652.50	1262.50	16.25*	95	208.75	113.75	10.65*
Overall	1320	2605.00	1285.00	14.35*	90	205.25	115.25	11.84*

\* Significant at one percent level

**Table 4: Empowerment of members of selected self help groups in various economic aspects**

Aspects	Majha (n <sub>1</sub> =62)		Malwa (n <sub>2</sub> =58)		Doaba (n <sub>3</sub> =80)		Overall (N=200)	
	f	Per cent	f	Per cent	f	Per cent	f	Per cent
Investment on books	16	25.80	14	24.13	29	36.25	59	29.50
Paying fee of children	25	40.32	24	41.37	30	37.5	79	39.50
Spare time for teaching child	14	22.58	21	36.20	22	27.5	57	28.50
Increased use of milk intake	12	19.35	17	29.31	13	16.25	42	21.00
Understand banking operations	55	88.70	48	82.75	60	75	163	81.50
Higher price for products	57	91.93	55	94.82	70	87.5	182	91.00
Purchased mobile phone					3	3.75	3	1.5
<b>Contributed money towards purchase of</b>								
Tractor	1	1.612903	1	1.724138	5	6.25	7	3.5
Tata Sumo/Bolero	2	3.22	2	3.44	1	1.25	5	2.50
A.C					1	1.25	1	0.50

\*Multiple response

**Table 5: Managerial impact on women in selected self help groups**

Aspects	Majha (n <sub>1</sub> =62)		Malwa (n <sub>2</sub> =58)		Doaba (n <sub>3</sub> =80)		Overall (N=200)	
	f	Per cent	f	Per cent	f	Per cent	f	Per cent
Helped in input procurement	19	30.64	15	25.86	32	40	66	33.00
Proper use of time and resources	47	75.80	46	79.31	72	90	165	82.50
Enhanced the ability to take risk	60	96.77	50	86.20	77	96.25	187	93.50
Increased my contacts with officials from different sources	28	45.16	17	29.31	34	42.5	79	39.50
Learnt to try new ventures	18	29.03	19	32.75	22	27.5	59	29.50
Improved performance in the task	40	64.51	48	82.75	64	80	152	76.00
Able to manage various activities of groups	60	96.77	57	98.27	74	92.5	191	95.50
One's unique potential	59	95.16	54	93.10	78	97.5	191	95.50
Understand group goal	59	95.16	55	94.82	78	97.5	192	96.00
Courage to think and act independently	62	100	57	98.27	80	100	199	99.50

\*Multiple responses

### Social impact on women of selected self help groups

It is quite clear from the data placed in Table 6 that majority of the respondents in all the 12 groups reported that team spirit (97 per cent), confidence in dealing with people (95.50 per cent), confidence in talking within family (94 per cent), ability to aspire for a better future (93.50 per cent) and developing social relationships (92.50 per cent) had been increased. This may be due to the fact that socialization in small groups provides opportunities to express freely, develop team spirit, change the attitude of member that are socially acceptable thereby increasing self confidence among the members of self help groups. The results were in track with the findings of Murthy (2013) who also reported that self confidence of members of self help groups was improved after joining the group. A small change was observed regarding organizing social functions (4 per cent) and social recognition (4.50 per cent).

It is remarkable to point out that social impact of *Doaba* region in terms of confidence in dealing with people (96.25 per cent), talking freely within family (90 per cent), shunning of inhibitions (81.25 per cent) was enhanced more than *Malwa* and *Majha* region. The figures in Table further depicted that team spirit (100 per cent) and leadership skill (87.93 per cent) was improved much in *Malwa* region as compared to other two regions.

### CONCLUSIONS

The study highlighted that majority of the members of all the self help groups increased their income and savings in the range of ₹1000-1500 and ₹50-100 per month for the economic upliftment. The other economic benefits availed by the members from joining the group were receiving higher price for marketing the product collectively and understanding of banking operations. Among the managerial impact, courage to think and act independently, understanding goal of group and realizing

**Table 6: Social impact of women of selected self help groups**

Aspects	Majha (n <sub>1</sub> =62)		Malwa (n <sub>2</sub> =58)		Doaba (n <sub>3</sub> =80)		Overall (N=200)	
	Improved	Remained the same	Improved	Remained the same	Improved	Remained the same	Improved	Remained the same
	f	f	f	f	f	f	f	f
Confidence in dealing with	59 (95.16)	3 (4.83)	55 (94.82)	3 (5.17)	77 (96.25)	3 (3.75)	191 (95.50)	9 (4.50)
Confidence in dealing with different organizations	38 (61.29)	24 (38.70)	21 (36.20)	37 (63.79)	48 (60.00)	32 (40.00)	107 (53.50)	93 (46.50)
Talk freely within family	58 (93.54)	4 (6.45)	58 (100)	0	72 (90.00)	8 (10.00)	188 (94.00)	12 (6.00)
Shunning of inhibitions	49 (79.03)	13 (20.96)	42 (72.41)	16 (27.58)	65 (81.25)	15 (18.75)	156 (78.00)	44 (22.00)
Leadership skill	50 (80.64)	12 (19.35)	51 (87.93)	7 (12.06)	64 (80.00)	16 (20.00)	165 (82.50)	35 (17.50)
Social relationships	61 (98.38)	1 (1.61)	54 (93.10)	4 (6.89)	70 (87.50)	10 (12.50)	185 (92.50)	15 (7.50)
Breaking societal taboos/values	40 (64.51)	22 (35.48)	24 (41.37)	34 (58.62)	61 (76.25)	19 (23.75)	125 (62.50)	75 (37.50)
Team spirit	57 (91.93)	5 (8.06)	58 (100)	0	79 (98.75)	1 (1.25)	194 (97.00)	6 (3.00)
Social recognition	2 (3.22)	60 (96.77)	1 (1.72)	57 (98.27)	6 (7.50)	74 (92.50)	9 (4.50)	191 (95.50)
Improvement in personal health	46 (74.16)	16 (25.80)	40 (68.96)	18 (31.03)	59 (73.75)	21 (26.25)	145 (72.50)	55 (27.50)
Organizing social functions	3 (4.83)	59 (95.16)	4 (6.89)	54 (93.10)	1 (1.25)	79 (98.75)	8 (4.00)	192 (96.00)
Ability to aspire for a better future	59 (95.16)	3 (4.83)	55 (94.82)	3 (5.17)	73 (91.25)	7 (8.75)	187 (93.50)	13 (6.50)
Power to influence	25 (40.32)	37 (59.67)	19 (32.75)	39 (67.24)	49 (61.25)	31 (38.75)	93 (46.50)	107 (53.50)
Free from cheating from money lenders	53 (85.48)	9 (14.51)	42 (72.41)	16 (27.58)	57 (71.25)	23 (28.75)	152 (76.00)	48 (24.00)

\*Multiple response

Figures in parentheses indicate percentages

their full potentials emerged as the major aspects perceived by the respondents. It may be due to large contribution by all the members in group activities. It could be further indicated from the study that social impact in relation to team spirit, confidence in dealing with the people and talking freely within family were also promoted. The study recommended that economic, managerial and social aspects of self help groups are important for evaluating progress of any self help groups and these three are inter-related with each other and cumulative effects of these aspects need to be taken into consideration for enhancing the income of women.

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## **Impact of Decentralised Rainwater Harvesting Structures on Farm Income, Variable Input Usage and Livestock Possession in Semi-arid Tracts of India: Regression Analyses<sup>#</sup>**

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### **ABSTRACT**

To sustain the growth of agriculture and feed its growing population, India needs to shift to semi-arid regions characterised by water scarcity for irrigation. Rainwater harvesting is a potential solution to this problem in future. Decentralised rainwater harvesting systems have been developed to overcome the demerits of community based watershed structures. Using robust least square regression it was found that among various factors, adoption of rainwater harvesting structures is significant at 5 percent level of significance and plays important role in not only increasing the farm income but also increasing the use of yield enhancing inputs like fertiliser (1 per cent level of significance), seed (5 per cent), labour (1 per cent) and farmyard manure (1 per cent). Livestock possession was also found to be significantly influenced by adoption at 1 percent level of significance.

### **Keywords**

Farm income, farmyard manure, fertiliser, labour, robust least square, seed

### **JEL Codes**

C82

### **INTRODUCTION**

India has made great progress in providing food security for its people. The growth of food production has surpassed the growth of population, with per capita food availability increased from 167 kg per year during 1980-1990 to 186 kg per year during 2013-14 (India Stat, 2014). Indian policy makers have shifted their focus from self-sufficiency to generating additional income in rural areas (Ahluwalia, 2004). But will India continue to be self-sufficient in foodgrains in the years ahead with declining net cropped area? Indian agriculture is entering into a new phase. The conventional mode of agriculture through intensive agricultural practices was successful in achieving goals of production, but simultaneously led to degradation of natural resources. Among all the resources, irrigation occupies an important place, as it enables diversification of cropping patterns with crops

grown all year round. The expansion of irrigation not only enables yield improvement but also facilitates high-yielding agriculture practices involving the use of chemical fertilizers and high-yielding varieties. India is a large country which supports about 1/6<sup>th</sup> of the world's population, 1/50<sup>th</sup> of the world's land and 1/25<sup>th</sup> of the world's water resources (Water Management Forum, 2003). Despite being endowed with mighty rivers like the Ganges, the Brahmaputra, the Krishna, and, the Godavari etc., the uneven distribution of rainfall across the country at different times of the year causes several parts of India fall under the water stressed, water scarcity and absolute water scarcity categories. Most of this water stressed and water scarce zones fall in the arid and semi arid regions that are in general characterized by low and erratic annual rainfall, high evaporation and low groundwater availability (Glendenning *et al.*, 2012). Considerable part

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of India's poorest population lives in the nation's semi-arid tropical areas. Around there, deficiencies of water and repetitive drought block the agricultural transformation that the Green Revolution accomplished somewhere else (IFAD, 2013). Their means of livelihood rely upon failure or success of the crops due to erratic rainfall. The contribution of rainfed agriculture in India is around 42 per cent of the food grains, 75 per cent of oilseeds, 90 per cent of pulses and around 70 per cent of cotton (Reddy, 2011). Arid and semi arid agriculture offers greater scope for development of agro forestry, horti-sylvi-pasture and social forestry which provides livelihood and ecological support.

Rajasthan is one of the most drought affected states of India. Among the total of 33 districts, 15 districts are coming under semi arid, 15 in arid zones as per the guidelines provided by Rainfed Area Development Programme (Anonymous, 2011). The pressure of food production mainly relies on the semi arid areas (marginally more productive lands as compared to arid zones) of the state. This has led to the overexploitation of available groundwater in these areas.

To ensure the past gain and search for alternatives for depleting resources, the resource conservation technology has received the high priority to sustain and further enhance the resource productivity to meet the emerging need of fast growing population (Rockstorm *et al.*, 2010). Most of the recent technologies developed in agricultural sector have been directed towards water conservation like Pusa Hydrogel, micro irrigation systems through drip and sprinkler methods, precision mobile drip irrigation, pivot irrigation systems, etc. But these are sophisticated technologies and found to be expensive. In India, nearly 85 per cent of the farmers are small and marginal, with high rate of illiteracy and lack of adequate extension services (Economic Survey, 2015). These technologies do not seem to percolate to each and every farmer in near future. It calls for new practices which offer a sagacious mix of new technologies and traditional wisdom to enhance sustained productivity. Rainwater harvesting offers one of the pathways in this direction. It has also been reported that there are growing scarcities for water in many areas, as its use is increasingly exceeding the availability suggested that the expediency in such areas is to plug the demand-supply gap by conserving water through rainwater harvesting (Deng *et al.*, 2004; Kishore *et al.*, 2005). Rainwater harvesting means utilising the erratic monsoon rain for raising good crops in dry tracks and conserve the excess runoff water for irrigation, drinking and for recharging purposes. In agricultural perspective, it is a practice of converting blue water into green water (Sivanappan, 2006). Modern structures include water storage tanks, farm ponds, diggias, baoris, check dams, contour ridges, semi circular and trapezoidal bunds, contour terraces, small pits, etc. (Sakthivadivel, 2007; Anonymous, 2011). Rainwater harvesting has been benefiting the farming

population in several ways. They have helped in soil and water conservation for higher yield as their primary role by providing supplemental as well as lifesaving irrigations (Li *et al.*, 1999; Malik *et al.*, 2014). In addition the restored resources such as forests, underground water, fisheries and apiculture expand the scope for earning livelihood for the rural population. The goal of crop diversification as well as social and ecological diversification can be achieved through these practices. It can help building resilience and sustainable gains and public participation (Dile *et al.*, 2013). Though in many areas, of adoption of water harvesting technologies have been observed, but not yielded fruitful results as desired. Moreover, many water harvesting technologies were implemented at large scale particularly on watershed basis. At community level, upstream farmers are deprived of, although downstream farmers are getting benefitted. Under large irrigation projects, the problems of soil salinity, reservoir induced seismicity, sedimentation and hazardous microclimatic changes were also reported.

Based on financial feasibility analyses the individually owned rainwater harvesting structures were found to be profitable in semi-arid tropics (Pandey, 1991; Liang & Dijk, 2011). It was endeavoured to promote individual farm scale decentralised water harvesting structures to benefit rainfed farmers for their livelihood improvement. Although, impact has been assessed in watershed based water harvesting technologies at community level, there is seldom any study on assessing impact of farm ponds at micro scale. Much of the economic research examines impact of watershed development projects on welfare and calculates benefit cost ratios, where rainwater harvesting is mere one of the components among many soil and water conservation measures (Joshi, 2008). The farm income and other farm attributes were also reported to be influenced by the adoption of various water conservation measures (Amha, 2008; Ward, 2014). Some of the past studies have tried to analyse the various determinants of farm income and input usages such as education, off farm income, age, farm size, various farm investments using regression analysis (Ibekwe *et al.*, 2010; Birthal *et al.*, 2014). Hence this study was planned at assessing the impact of decentralised water harvesting structures on variable input usages, livestock possession and overall farm income in semi arid areas of Rajasthan using regression analyses.

## **METHODOLOGY**

### **Sampling Framework**

Rajasthan was purposively selected as it has maximum percentage of area under arid and semi-arid regions and many soil and water conservation programmes are implemented in the state. Two districts, namely Karauli and Tonk were selected purposively based on agro-climatic region and concentration of water harvesting structures. Two blocks from each district and two villages from each block were also selected

purposively. Finally, the households were selected randomly from the list of adopters and non-adopters available with the government officials of the blocks.

A survey of total 120 households was conducted, 60 from each districts, 30 from each block and 15 from each village. Overall, 60 households were those who have adopted rainwater harvesting structures and rest were the non-adopters.

#### Data Sources

The primary data was collected through comprehensive schedules exclusively prepared for the study from farmer by personal interview method. The schedules used for the primary data collection was designed as per the objectives of the study. The data were collected in relation to (i) General profile of the farmer (ii) Farmer specific variables (iii) Farming variables (iv) Location specific variables (v) Institutional variables (vi) Perception variables (He *et al.*, 2007).

#### Analytical Tools

EViews 8 software package was used for regression analyses involved in the study. The sampled data set was found to contain few outliers which might deviate from the results explained using majority of the data. Also, as seen in Table 1, using Jarque Bera test, many of the variables were found to deviate from classical normal distribution (Gujarati *et al.*, 2012). Under these conditions least square estimation would have resulted in misspecification error. To cope with this problem by

identifying and masking the effects of outliers, robust least square regression was used (Finger & Hediger, 2008).

#### Impact of adoption of rainwater harvesting structures on variable inputs usage, livestock possession and farm income.

Different models were attempted to assess the impact of water harvesting structures on inputs and farm income.

The dependent and independent variables used in various models are as follows:

- Farm income (Y) in Indian Rupees.
- Labour (L) in mandays used.
- Seed(S) in terms of money spent on purchasing seeds.
- Livestock (O) in number.
- Farm Machinery (Tractor, Sprayer and Pump) in number.
- Farmyard Manure(FYM) in tonnes used per hectare
- Fertiliser (F) in terms of money expenditure in Indian Rupees.
- Farmer Specific Variables (FSV): Age (number of years), Education(dummy variable 1 and 2 for primary level and above respectively, 0 otherwise), Active members of family involved in farming (number) and Off farm income (Indian Rupees).

**Table 1: Descriptive statistics of the variables used in the analyses**

Variables	Mean	Max.	Min.	Std Dev.	JB	Prob.
Active members	2.44	5	1	0.89	6.63	0.04
RWH	0.50	1	0	0.50	20.00	0.00
Age	53.92	80	33	10.62	2.28	0.32
Attitude	0.73	1	0	0.44	26.20	0.00
Credit	0.65	1	0	0.48	20.78	0.00
HerfindahlIndex	0.69	1	0.17	0.22	10.42	0.01
Distance	14.07	25	2	5.42	2.08	0.35
Education	0.85	2	0	0.57	0.11	0.95
Erosion	0.99	2	0	0.73	6.00	0.05
Farm income	1.70	5	0.2	1.22	13.83	0.00
Farm_Size	3.22	8	0.75	1.53	18.15	0.00
Fertilizer	8.07	20	2	3.54	43.91	0.00
FYM	17.97	50	10	6.98	138.08	0.00
Extension	0.48	1	0	0.50	20.00	0.00
Labour	38.63	90	10	19.65	8.98	0.01
Livestock	2.64	7	1	1.36	13.35	0.00
Off farm income	0.41	5	0	0.79	882.09	0.00
Pump	0.58	2	0	0.53	7.89	0.02
Risk_Preference	0.64	1	0	0.48	20.61	0.00
Seed	4.13	12	1	1.92	175.90	0.00
Sprayer	1.05	2	0	0.50	5.01	0.08
Subsidy	0.46	1	0	0.50	20.00	0.00
Tractor	0.25	1	0	0.43	28.89	0.00

Max.= maximum value; Min.= minimum value; Std Dev.= standard deviation; JB= JarqueBera statistic; Prob.= probability of value of Jarque Berastatstic

- Perception variables (PV): Attitude towards Rainwater Harvesting adoption and Risk preference of head in the family.
- a. Attitude of the farmer was taken in dummy form obtained from Likert scale procedure.
- b. Risk preference was obtained by asking five mutually exclusive response based question to the respondents. For example whether he/she is a beneficiary under any programme, health problems, storage facility, bad habits and whether he/she is a risk seeker or averter. If three or more responses were on positive side, the respondent was considered to have favourable attitude towards risk and was assigned dummy variable 1 or else 0 (Kothari and Garg, 2014).
- Farming Variables (FV): Farm size (ha) and crop diversification. The values of crop diversification were obtained by using Herfindahl Index (HI). The value of HI was obtained using the following formula

$$HI = \sum_{i=1}^N P_i^2$$

- Where N is the total number of crops and  $P_i$  represents area proportion of the  $i^{th}$  crop in total cropped area. The Herfindahl Index would decrease, with increase in crop diversification. This index approaches one when there is complete concentration and takes a value of zero when there is perfect diversification. Thus, the index is bound to be between zero and one (De & Chattopadhyay, 2010).
- Location Specific Variables (LSV): Erosion (dummy variables 1 and 2 for high and medium intensity, 0 otherwise), Distance of the plot from the nearest road/ town (km).
- Institutional variables (IV): Contact with extension workers, credit provision and subsidy (all in terms of dummy variables, 1 if accessible, 0 otherwise).
- Adoption of Rainwater Harvesting Structure (RWH): (dummy variable 1 if adopter, 0 otherwise)

#### Impact on variable inputs and livestock possession

The impact of rainwater harvesting structures (RWH) on the variable inputs like labour (L), seed (S), livestock (O), Fertiliser (F) and farmyard manure (FYM) was analysed using robust regression model with the other variables like farmer specific variables (FSV), perception variables (PV), farming variables (FV), location specific variables (LSV), institutional variables (IV) as follows:

$$\begin{aligned} L &= f(\text{FSV, PV, FV, LSV, IV, RWH}) \\ S &= f(\text{FSV, PV, FV, LSV, IV, RWH}) \\ O &= f(\text{FSV, PV, FV, LSV, IV, RWH}) \\ F &= f(\text{FSV, PV, FV, LSV, IV, RWH}) \\ \text{FYM} &= f(\text{FSV, PV, FV, LSV, IV, RWH}) \end{aligned}$$

#### Rainwater Harvesting and farm income.

Three models were considered for estimating the adoption of water harvesting structures on farm income.

##### Model A: Full Model

In Model A, the farm income was modeled as a function of labour (L), seed (S), livestock (O), fertiliser (F) farmyard manure (FYM), farm machinery (M), farmer specific variables (FSV), perception variables (PV), farming variables (FV), location specific variables (LSV), institutional variables (IV) and adoption of rainwater harvesting structures (RWH). This model is a complete model with all the variables considered for the study, written as:

$$Y = f(L, S, O, P, M, F, \text{FYM}, \text{FSV}, \text{PV}, \text{FV}, \text{LSV}, \text{IV}, \text{RWH})$$

##### Model B: Structural Model

Unlike the traditional simultaneous models, here, structural models are derived on basis of review of related studies and include observable variables which have direct effect on dependent variables. The independent variables in this model implicitly explain the latent or unobservable variables which are removed (Reiss and Frank, 2007). As the effect of farmer specific variables (FSV), perception variables (PV), farming variables (FV) (only crop diversification), location specific variables (LSV), institutional variables (IV) and adoption of farm ponds (RWH) may be indirectly through the use of inputs; these variables could be removed from the full model stated above. The structural model came out to be as follows:

$$Y = f(L, S, O, P, M, F, \text{FYM})$$

##### Model C: Reduced Model

This final model included all the variables excluded in the second structural model but excluded the inputs taken in the same. This type of specification tends to avoid the possibility for endogeneity bias (Amha, 2008). The reduced model was defined as:

$$Y = f(\text{FSV, PV, FV, LSV, RWH})$$

As the dataset was found not to follow the normal distribution, robust least square procedure was followed.

#### RESULTS AND DISCUSSION

As clear from Table 2, adoption of rainwater harvesting structures was found to be significant at 1 percent level of significance for fertiliser, farmyard manure, labour and livestock whereas for seed it was significant at 5 percent level of significance. Credit was found to be significant only for FYM use at 5 percent level of significance. Herfindahl index as a measure of crop diversification at farm level was observed to influence fertiliser and labour at one percent whereas FYM and livestock at 5 percent level of significance. Labour usage was positively related to labour. Farm size was found to be statistically and positively related with fertiliser, FYM, labour and seed. Risk preference was found to influence FYM and labour negatively at 5 and 1 percent level of significance whereas livestock positively at 10 percent level of significance.

**Table 2: Impact of water harvesting on input usage and livestock possession**

Variables	Coefficient				
	Fertiliser	FYM	Labour	Seed	Livestock
RWH	1.831***	8.800***	15.847***	0.600**	0.999***
Active Members	0.091	-0.451	-0.662	-0.017	-0.038
Age	0.003	0.018	0.052	0.016*	-0.003
Attitude	0.051	-0.273	1.584	-0.021	-0.066
Distance	-0.025	0.025	0.120	-0.006	-0.021
Credit	-0.157	1.643**	0.382	-0.016	0.157
HI	-4.024***	5.456**	-15.269***	-0.694	-1.036**
Education	-0.020	0.268	2.867**	0.138	0.244
Erosion	-0.057	0.693	0.181	-0.222	0.018
Farm Size	0.966***	2.313***	7.906***	0.517***	0.295
Extension	-0.248	-0.440	-0.084	0.080	0.217
Offfarm income	0.048	-0.360	-0.764	0.035	0.007
Risk Preference	0.238	-1.814**	-3.764***	-0.066	0.048*
Subsidy	-0.218	-0.805	0.689	0.271	-0.387
Intercept	6.791	1.661	11.574	1.695	2.136
R-squared	0.583	0.616	0.728	0.508	0.521
Adjusted R-squared	0.527	0.565	0.692	0.442	0.457

\*\*\*, \*\* and \*Significant at 1, 5 and 10per cent level

**Table 3: Impact of rainwater harvesting on farm income**

Variables	Coefficients		
	Full	Structural	Reduced
RWH	0.488**	-	0.651***
Fertilizers	0.084***	0.12***	-
FYM	-0.010***	0.02	-
Labour	0.016	-0.03***	-
Livestock	0.059	0.13**	-
Seed	0.036	0.10	-
Pump	-0.100	0.24**	-
Sprayer	0.285***	0.13	-
Tractor	0.305***	-	-
Subsidy	-0.145	-	-
Credit	-0.034	-	-
Farm Size	-0.042	-	-
Active members	-0.047	-	-0.007
Age	0.012***	-	0.007
Attitude	-0.035	-	0.046
Crop diversification	-1.851***	-	-2.679***
Distance	-0.012*	-	-0.025***
Education	-0.006	-	-0.064
Erosion	0.042	-	-0.074
Extension	-0.008	-	0.077
Off farm income	-0.084*	-	0.081
Risk preference	0.081	-	0.231**
Intercept	0.880***	-1.06***	3.036***
R-squared	0.713	0.52	0.638
Adjusted R-squared	0.648	0.49	0.602

\*\*\*, \*\* and \*Significant at 1, 5 and 10 per cent level

A regression was fitted with farm income as dependent variable and adoption of rainwater harvesting structures along with farm, farmer, perception and institutional variables (Table 3). In model 'A' (full model) in which adoption of WHS was found highly significant at one percent level along with fertiliser, sprayer, tractor, age and crop diversification. FYM was also found to influence farm income at 1 percent level of significance but negatively. Distance and off farm income also showed negative and significant effect at 10 percent level of significance.

Model B is a structural model and the model is fitted considering mainly the input variables as independent variables while dropping other institutional and perceptual variables. This model also excludes adoption of rainwater harvesting structures assuming its indirect effect on farm income in the form of irrigation. The result showed that fertilizer and labour usage were found to significantly affect the farm income at one percent level positively and negatively respectively. The model also depicted positive influence of livestock and possession of irrigation pump on farm income at five percent level of significance.

In model C that is a reduced model also adoption of WHS was found to be significantly impacting farm income at one percent level of significance. Crop diversification and distance also showed statically significant relation at 1 percent level positively and negatively respectively. Risk preference of the farmer also showed positive effect on farm income at 5 percent level of significance.

#### DISCUSSION

Adoption is positively related to the expenditure on fertiliser. This is in consonance with the hypothesized statement. Higher level of irrigation, the higher the level

of fertiliser application (Mohanam, 2002). Fertiliser was found significantly related with sizes of the land holding which is an expected result. With larger land holdings volume of seeds and other inputs also increases. This also requires proportional increases in fertiliser. Positive relation with extent crop diversification can be attributed to more specific fertiliser requirement for various crops.

Adoption of rainwater harvesting structures was found to be in line with use of FYM which is significant. With former having good impact on soil health by reducing soil erosion and increasing greenery and soil moisture, the effect of FYM on crop yield gets synergised (Satyanarayana *et al.*, 2002). Farmers with more access to credit were also reported to use higher dosages of FYM. On per unit nutrient basis the cost of FYM comes out to be much higher as compared to that of fertiliser. This means that he would require more capital which can be obtained using credit. Relationship of FYM with higher risk preference was found to be significant but negative as the risk preferring farmer expects quick results over a short period of time. But FYM provides slow nourishment to the soil as compared with fertiliser. As a result he would prefer more of latter over FYM. The positive significant relationship with extent of diversification of cropping pattern is also in line with above relationship as a risk averter farmer will go for farm diversification. With larger farm size, more use of FYM was observed. The farmer with large farm size would get high production in terms of volume as compared to the small sized land holders. So he can sacrifice some portion of his production for achieving maintenance of soil health and sustainability. Adoption of rainwater harvesting structures was also found to be highly significant at 1percent level of significance implying that after the fulfillment of irrigation requirement of the farm the other inputs would also become responsive and would increase the yield. As a result, requirement of labour would increase as compared to non-adopters (Norman *et al.*, 2008). Also higher income for the adopters, enable them to hire sufficient labour as per their requirement. It also resulted in higher employment, raising their standard of living and thus, alleviating poverty (Shitundu and Luvanga, 1998).

The estimation results have shown that risk preference was found to be inversely related to the labour usage. The most probable reason for this could be that the risk preferers might be going for owned or hired mechanised farm operations which subsequently reduce the requirement of farm labour. Farm size was also found to be significantly related to labour. Larger area would yield higher production of crops which would need more labour than those who were having smaller land holdings. Education status of head of the farming family was found to influence the labour usage. The negative relation of HI with farm income shows that with increase in crop diversification labour use also intensifies as the various there is increased intercrop operations at the farm.

Adoption of rainwater harvesting structures was

found to be significantly influencing the expenditure on seeds. The improved and high yielding varieties of seeds are more responsive to irrigated soils as compared non irrigated ones (Jin *et al.*, 2012). Age of the farmers was found to be positively related with the expenditure on seeds. Most of the old aged and experienced farmers with good farm level knowledge were reported to purchase commercial improved seed varieties rather than own farm produced seeds. Farm size was noted to be positively related with the seed usages. With larger size he could reach higher economies of scales and increase his income by spending more on improved varieties of seeds.

As it was observed that saline groundwater was used for livestock in some of the sampled villages, a positive relationship of number of livestock possession was found out with adoption of farm ponds was found. With the adoption of water harvesting structures, there has been an increase in cropping intensity as the acreage under wheat in rabi season is more. With increase in area under cultivation due to adoption of rainwater harvesting, grazing land certainly got reduced but notable increase in the availability of fodder from crop residues was reported. Hence, this might have resulted in a positive relationship of water harvesting with the possession of livestock in the study area (Aredo *et al.*, 2005). Number of livestock possessions was found to be negatively correlated with HI revealing higher extent of crop diversification. This may be due to fodder requirements as well as higher availability of -animal manure for various crops.

Adoption of rainwater harvesting also showed positive and highly significant impact on the farm income in full and structural models which confirms that in addition to direct effects rainwater harvesting also has indirect impacts on farm income. Overall, the estimation results have shown that water harvesting plays a critical role in positively with farm income in semi arid regions. As depicted in full and structural models, there has been increase in farm income as a result of unit increase in the farm size. The volume of farm produce is greatly influenced by the farm size. Larger farm size also allows for economies of scale using mechanisation and large scale investments (Anriquez and Valdes, 2006). Likewise expenditure on fertiliser was also found to have positive relationship with farm income. Number of livestock with farming household has also shown positive relationship with farm income in the structural model. It allows farmers to earn subsidiary income as well as provides manure for the farm use. This might have been probably the reason for the positive relationship. Influence of expenditure on seeds on farm income was also found significantly positive. High priced and improved varieties of seeds are more remunerative as compared to locally produced seeds. Negative coefficient for labour usage revealed that high income farmers had higher degree of mechanisation. Higher age of the farmers revealing more experience and intense farm level knowledge also resulted in higher income. Negative coefficient of HI i.e.

higher extent of crop diversification was found to have positive relationship with farm income in both the models. With increase in irrigated area crop diversification tends to shift towards more of high valued crops (Abro, 2012). The crop diversification reduces the variability in income and ensures continuous flow of income at farm level irrespective of any unforeseen calamities. More distance of farm from nearest town resulted in lowering the farm income as increased marketing costs due to higher transportation charges. Moreover, some of the far situated farmers from the town were also found to be negligent enough to sell their produce in local markets at lower prices, thus reducing the farm income. Higher off farm income provides a sense of economic security to the farming households so that they don't feel the need to depend on farm income.

### **CONCLUSIONS AND IMPLICATIONS**

The above study was undertaken to analyse the impact of decentralised rainwater harvesting structures on various input usages, livestock and farm income. Some meaningful conclusions with useful implications emerged out from the analyses.

Results of impact on input usages suggest that to enhance the improved, high yielding and eco friendly inputs the adoption of individually owned rainwater harvesting should be promoted. Rather than subsidising these inputs, higher incentives can be given to the farmers for the construction of these structures. Similarly, livestock possession can also be increased through adoption of rainwater harvesting to provide farmers of semi arid regions platform for economically and ecologically sustainable pathways like integrated farming systems and agro-silviculture. The results from three different models tried to estimate the impact of adoption of rainwater harvesting structures on farm income suggest that farm income can be increased by many factors. Among these rainwater harvesting structure is the most important one. The highly and statistically significant value in structural model confirmed the dominance of the adoption of these structures among various determinants of farm income which have direct effect on the same. On the other hand, reduced model showed the indirect effect of rainwater harvesting on farm income.

These models imply that the to increase the farm income water harvesting structures play a big role and thus the extension workers should find out the ways to enhance their adoption. The agronomists and engineers should come up with location specific, cost effective and user friendly designs of these structures to accelerate their adoption at high rate which would result in increased farm income. At present, increase in farm income is necessary to bring about professionalism and higher benefits in agriculture. This would help to prevent the farmers from switching over to other low level occupations.

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## **An Econometric Analysis of Farmer's Distress in Andhra Pradesh: A Logistic Regression Analysis**

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### **ABSTRACT**

*Theodore Schultz's rightly pointed in his Nobel Prize lecture, "Most of the world's poor people earn their living from agriculture, so if we knew the economics of agriculture, we would know much of the economics of being poor." The farm activities all over India are dwindling down. Based on the analysis carried out and field survey, it can be observed that the independent variables which influences the farmer's distress are quite different between irrigated and rainfed areas in North Coastal Andhra region It's time for encouraging the Agriculture Scientist Subhash Palekar's Zero Budget Spiritual Farming or Nature Farming.*

### **Keywords**

Dependency ratio, logistic regression, odds ratio, ware houses

### **JEL Codes**

C82, C87, O13, Q18

### **INTRODUCTION**

In the words of Mahatma Gandhi Villages are backbone of India and agriculture is the soul of Indian economy. These words still ring true today. A Noble Prize Winner Theodore Schultz's rightly pointed out that "Most of the world's poor people earn their living from agriculture, so if we knew the economics of agriculture, we would know much of the economics of being poor." Economic development and prosperity of developing economies mainly depend on the growth of two important sectors viz., Agriculture and industry. Service sector is the resultant growth or supplementary of these two sectors independently or interaction of the forces of the growth of these two sectors, besides the impact of global demands. Though the share of agriculture in Gross Value Added (GVA) is declining, still it is providing employment to large section of population and hence it cannot be neglected.

#### **An Over View of Indian Agriculture**

Indian agriculture has come a long way since independence, with food scarcity giving way to self-sufficiency despite a two- and- a half fold increase in population. After the Rainbow Revolution, the tremendous increase in aggregate food grains output solved a little bit of food security in India. In recent, two

things alarm, that cultivable land per person in India is much sharper than in other countries. Over the next twenty years, India's fast population growth will make the cross country comparison even less favorable for India. World's leading agricultural countries Brazil and China use approximately 60 per cent (FAOSTAT) of their renewable fresh water resources for their agriculture purposes whereas in India the same was a little over 90 per cent. The primary challenge of Indian agriculture is low productivity, which is evident in main food grains of pulses and principle cereals viz., paddy and wheat. These food grains especially the principle crops viz., paddy and wheat are grown under the most fertile and irrigated areas in the country. Also, water, fertilizer and pesticides, power, credit or procurement under Minimum Support Price Programme (MSP) and manpower sources were use largely in the country. Even though, the average yields of wheat and paddy in India being 39 per cent and 46 per cent respectively, this is below than China. In wheat, India's average yield is 3075 kg per hectare in 2013 which is lower than the world's average of 3257 kg per hectare. The yields of paddy in India are comparatively lower than the China. India's best state Punjab had the yield of paddy was to 6000kg/ha whereas China's yield of paddy was 6709 kg/ha. India happens to be major consumer and

producer of pulses but India has low yields comparable to most of the counterpart countries.

Another side of the farm distress was low farm incomes in India. The negative consequences of low agriculture yields extend from shaky incomes of farmers to large tracts of land locked in low value agriculture, despite growing demands for high value products like fruits and vegetables, livestock products because of consumption diversification with rising incomes and urbanization. The 70<sup>th</sup> round of National Sample Survey stated that the average income of the median farmer's net production costs from cultivation is less than ₹20000.00 in 17 states in India. Whereas Andhra Pradesh is Twelfth state among the 30 states in India in ascending order. The system has been snapped by three weaknesses. One, in states where agriculture is relatively more important which is supported their share of agriculture in state GDP's and the agriculture education is very weak. This is especially true in states in Northern and Eastern states. Secondly, India needs to increase investment in public agricultural research. But India's spend on agriculture research is considerably below than that of China and as a share of agriculture GDP even less than that of Bangladesh and Indonesia. Thirdly, resource augmentation can go only so far unless accompanied by changes in incentives. There is a strong need to take steps to enhance research productivity among the scientists in public research institutes by instituting performance indicators "as the majority (63.5 percent) of scientists had low level productivity."

These all reasons in Indian agriculture faced crisis of distressed conditions during the last one-half decade. The feeling of uncertainty among the agriculturalists in India is increasing with uncertain policies of coalition government at the centre and changing political scenario particularly in the state of Andhra Pradesh in respect of extending subsidies to major inputs like fertilizers, electricity to irrigation pump sets, credit advances by commercial banks and assured market prices. The states like Andhra Pradesh, Karnataka, Maharashtra, Punjab, and West Bengal which are popular for its agricultural products, are also witnessing a serious crisis of distressed conditions since the last one and half decade. It appears that the emerging challenges due to Globalization of Indian agriculture is likely to divide the farming community into two groups- one commercial high class of agriculturists with high degree of institutional investors and two a low traditional class of subsistence agriculturists who may vanish over time and become agricultural labourers or migrate to nearby towns and cities to live in slums.

#### **An Over View of Agriculture in Andhra Pradesh**

Andhra Pradesh economy is mainly based on agriculture and livestock and is one of the major food grains producing state in India. According to 2011 Census Sixty per cent of population is engaged in agriculture and allied activities. Rice is the major food crop and staple

food of the state. It is an exporter of many agricultural products and is also known as "Rice Bowl of India". In the total geographical area, 62.35 lakh hectares (38.1 per cent of total geographical area) accounted for net sown area, 41.30 hectares (26.37 per cent of total geographical area) in 2015-16 against 39.63 lakh hectares in 2014-15 area under food grains and cropping intensity is 1.26 per cent (Andhra Pradesh Economic Survey, 2015). The GVA growth rate in Andhra Pradesh is 10.99 per cent at 2011-12 current prices in 2014-15. Whereas in the sector wise growth rate of GVA of Andhra Pradesh at 2011-12 constant prices are 8.4 per cent, 11.13 per cent and 11.39 per cent for Agriculture, Industry and Service sectors accounted respectively. Gross irrigated area in 2014-15 accounted for 38.86 lakh hectares (23.88 per cent of total geographical area) and net irrigated area is 29.27 lakh hectares (17.98 per cent of total geographical area). Agriculture in Andhra Pradesh vagaries of monsoons, unpredictable weather conditions, escalating farm expenditure and non-profitability continues to be mainstay for millions of population in the state. Further huge dependency of population living rural areas on agriculture and the rural non-farm sector for livelihoods, employment and income. This indicates the role play by the agriculture in Andhra Pradesh remains crucial despite its volatility. The notable fact about agriculture in the state is the gradual transformation and diversification witnessed over the decade. This is not a good indication of any economy because previous studies notify that sustainable growth in agriculture is not only a key driver for economic development but also for achieving self-sufficiency and ensuring food security to the people.

In this context, most of the studies have been conducted on the livelihood and mitigation of poverty and the consequences of dependents on agriculture with a focus on social and economic factors. Problems such as rural poverty, livelihood of smallholdings, differ from region to region and the intensity varies from household to household. Area specific in micro level studies on survival are a few in numbers and time has come for researchers and academicians to conduct detailed analysis of factors behind suicides committed by farmers in India. This attitude is spreading as a virus and farmers felt that the only solution for them to overcome social and economic stigma attached to their poor performance and failure in agriculture, for no fault of them. In this situation, a study has been undertaken to identify social, economic and psychological factors behind farm distress. A brief review of studies in this area is presented below.

#### **Reviews of Earlier Studies**

In his study on irrigation scenario Patel (2016) stated that ground water through wells has 60.86 per cent share in total irrigation in his study. Almost more than 70 per cent of ground water potential has been utilized. This leads too many regions in water table has been falling at an alarmate. As against the rain fall, the ultimate irrigation potential of 140 million hectares estimated in

1997. Currently irrigation facilities of 102.8 million hectares are created and 45 per cent of country's net sown area (63.36 percent). According to World Development Indicators (1998) in the mid-1990 the percentage of irrigated area in India was less than the Bangladesh, Nepal, and China and less than half that in Japan and Korea. Crop yields in India are relatively lower than that East Asia and have almost stagnated despite a holding size that is larger on an average than in China. Rice yields in India are almost half that in Japan. Current Scenario exhibiting number of incomplete projects accompanied by low utilization of irrigation potential already created shows that returns on capital invested in creating irrigation facilities is in ordinally delayed or almost lost.

Justus & Samuel (2013), in their study take Tirunelveli district, Tamil Nadu. The study found that reduction in irrigation area from one season to another season mainly due to depletion of ground water. It shows that water irrigation level is below level and the utilization of land is more than one. All the irrigated area farmers borrowed money from different sources for the purpose of seeds, fertilizers, motor and pump sets develop land to promotion the irrigation facilities. The credit sources 41.8 per cent of total credit was extended by money lenders, 29.6 per cent by the regional rural banks, 17 per cent by co-operative banks, and 13.6 per cent by syndicate bank. The study identified the problems of farmers at different stages of farming viz., land utilization is insufficient, the re-usage of land is not sufficient, water development method is not satisfactory etc. The study suggests that encourage farmers to extend their agricultural outputs. Attempts should be made to eliminate the formalities of borrowing loans from the banks. Modern agricultural techniques must be made available to farmers at subsidized prices. Implementation of crop insurance to face the crop failures is essential.

“Socio-Economic status of agricultural women in drought hit area of Karnataka” was analyzed by Papannanavar (2016). He studied that Droughts and Floods are most dangerous environmental problems in all over world. These create two types of problems. Drought causes shortage of water and food grains. Floods damage the total settlement particularly agricultural settlement. The study found that respondent's socio-economic status has fluctuated by drought. The drought has severely affected the women's socio-economic status in Chitradurga district, Karnataka state. The findings need to stress to needful action should address agricultural women in particular tackling drought situations. The recommendations are irrigation facility to be provided for areas hit by drought, possible employment opportunities must implement for women, and special grant should be announced for drought affected areas.

#### **Need for the Study**

The adverse effects of the climate change, drought increase the cost of cultivation and decrease the returns on the agriculture leads to intensive care in farmers livelihood.

It cannot be stopped with single stroke and it needs a holistic approach with cooperation from not only all sections of the society but also with cooperation from all the countries throughout the world. It is a long-run issue. Now, the only solution to the problem is to mitigate the agricultural risks faced by the farming community through mechanizing the farming, increase the public investment in agriculture research and development, and educate young generation looking at agriculture through making the agriculture profitable and introduction of Crop Insurance. By designing the suitable policies with proper implementation mechanism, the farming community can be saved and filled with confidence levels to face the crop risks. With this background the agro-climatic region of North Coastal Andhra in the state of Andhra Pradesh, in which more number of the population depends upon agriculture for their livelihood, has been considered to study factors that influence the farmer's distress due to the state face drought quite frequently and commit suicide due to crop loss.

#### **METHODOLOGY**

To fulfill the objectives mentioned above, the following methodology has been adopted.

##### **A) Selection of the Sample Households**

A multi-stage stratified random sampling has been employed for the selection of the sample households. In the North Coastal Andhra Srikakulam district has irrigated area and Visakhapatnam district witnessed the rainfed area in this agro-climatic region identified by secondary data. Hence these districts are primary units and the second stage Garamandal from srikakulam district and Nakkapallimandal from Visakhapatnam district are selected on the same criteria. These are considered as secondary stage units and finally Jallulavalasa village from Garamandal and Vempadu village from Nakkapallimandal of respective districts of Andhra Pradesh State have been selected. From each village 50 farm households have been selected randomly. The study carried out in the period of December 31, 2015 to June 30 of 2016.

##### **b) Model Specification**

It is a quite common to use of dummy variables with Ordinary Least Squares (OLS) linear regression to analyzedichotomous variables. But it is difficult to use it when dichotomous variable is a explained variable (or dependent variable). In such a context probitor logit regression can be used with an advantage. But as an approximate method, OLS linear regression also does a surprisingly good job with dichotomous variables, despite clear-cut violations of assumptions. In this context, logit regression model is considered as a suitable model for the analyses and has been adopted. In the study dependent variable is whether the household becoming distress situation can be given a value (1) and otherwise given a value (0).

Logistic regression is estimated in the following form:

$$\ln\left(\frac{P}{1-P}\right) = \alpha + \beta_i x_i + u; \quad i=1,2,\dots,10$$

Where Ln= natural logarithm  
 P = Probability of obtaining a suicide case household  
 $Ln\left(\frac{P}{1-P}\right)$  = the log odds ratio of suicide case household.  
 $\alpha_i$ = a coefficient on the constant term  
 $\beta_i$ = coefficients of the ten independent variables  
 $X_i$ = independent variables, and  
 u= error term

If the coefficient of the independent variable (or explanatory variable),  $\beta$  is positive, it implies that the probability of becoming farm distress increases with increase in the explanatory variable. On the other hand, a negative coefficient would imply that the probability of becoming farm distress decreases with respect to increase in explanatory variable

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + u_i$$

Where Y = 1 i.e. the household becoming distress situation  
 = 0, Otherwise.

**Selection of Explanatory (or Independent) Variables**

To determine the factors that influence the farmers in distress situation in the study area (Andhra Pradesh), a logistic regression has been carried out. The explained variable is of dichotomous nature, assuming a value 1 if a farmer household becoming distress situation; zero value has been assigned otherwise. There is no doubt about the fact that the factors like volatility in prices, debt on high rate of interest and unable to repay, lack of awareness on the insurance schemes and so on influences the farmer to becoming distress situation. Besides these factors, the socio-economic and psychological factors may also have great influence on the farmer's decision loss their

livelihood. Hence, the following set of socio-economic factors has been considered as independent variables for the analysis on the basis of field experience. Age of head of the household( $X_1$ ), Education as binary (illiterate -1, otherwise-0) variable ( $X_2$ ), dependency ratio ( $X_3$ ), Farm insurance as binary (insured-1, otherwise-0) variable ( $X_4$ ), Agricultural Income per acre ( $X_5$ ), Agricultural expenditure per acre ( $X_6$ ), Income from livestock ( $X_7$ ), Involving in Non-farm activity ( $X_8$ ), Community Status ( $X_9$ ), Years of experience in farming ( $X_{10}$ ), Source of borrowing as binary (Institutional -1, otherwise-0) variable ( $X_{11}$ ), Warehouse facility as binary (Yes-1, No-0) variable ( $X_{12}$ ) and Indebtedness ( $X_{13}$ ).

**RESULTS AND DISCUSSION**

**Logistic Regression Model**

It can be seen from the Table 1 that, out of ten independent variables five variables Dependency Ratio ( $X_3$ ), Agricultural Income per acre ( $X_4$ ), Agricultural expenditure per acre ( $X_5$ ), Warehouse facility ( $X_9$ ) and Indebtedness per acre ( $X_{10}$ ) are statistically significant at different probability levels in the total study area. The positive sign of the estimated coefficient indicates that demand side factors mainly influences the farmer probably going to be distress.

**Dependency Ratio ( $X_3$ )**

The estimated coefficient of variable “Dependency Ratio ( $X_3$ )” is turned out to be statistically significant at 10 per cent probability level with negative sign in the total study area. The odds ratio of the variable indicates that a one per cent decrease leads to 0.149 times as lower the likelihood of chance of being to be distressed situation than counterparts (the farmer becoming non-distressed) and vice-versa.

With regard to irrigated area, the variable dependency ratio is statistically significant at 10 per cent probability level with a negative sign. The odds ratio of the variable

**Table 1: Results of the logistic regression model-Total area**

Independent Variable	Coefficient	Standard error	Z value	P-value	Odds ratio
Constant	2.802098	2.499809	1.12	0.262	
Age of the head of the household ( $X_1$ )	0.012392	0.0414433	0.3	0.765	1.012469
Education( $X_2$ )	0.7194886	0.8056072	0.89	0.372	2.053383
Dependency ratio ( $X_3$ )	-1.902511***	1.036235	-1.84	0.066	0.1491935
Agricultural income per acre ( $X_4$ )	-0.000254*	0.0000666	-3.81	0.000	0.9997461
Agricultural expenditure per acre ( $X_5$ )	0.0002071*	0.0000608	3.41	0.001	1.000207
Income from livestock ( $X_6$ )	6.53E-06	0.0000288	0.23	0.821	1.000007
Type of area( $X_7$ )	-0.3639135	0.9769306	-0.37	0.710	0.6949513
Source of borrowing ( $X_8$ )	-1.245498	0.9119874	-1.37	0.172	0.2877974
Warehouse facility ( $X_9$ )	-3.076744***	1.850628	-1.66	0.096	0.0461092
Indebtedness per acre ( $X_{10}$ )	0.000027***	0.0000155	1.74	0.081	1.000027
Number of observations	= 100				
LR Chi-Square (11)	= 83.84				
Prob> Chi-square	= 0.0000				
Pseudo R <sup>2</sup>	= 0.6076				
Log likelihood	= - 27.076713				

\* indicates significant at 1 per cent level

\*\* indicates significant at 5 per cent level

\*\*\* indicates significant at 10 per cent level

indicates that a one per cent decrease leads to 0.015 times lower the likelihood of chance of going to be distressed situation than counterparts (the farmer becoming non-distressed) and vice-versa.

With regard to rainfed area, the variable dependency is not statistically significant even at 10 per cent level of probability level. It is observed in field survey most of the younger members in the family shifted to near town for their live hood.

#### Agricultural Income Per Acre ( $X_4$ )

The estimated coefficient of the variable “Income per acre ( $X_4$ )” is turned out to be statistically significant at 1 per cent probability level with negative sign in North Coastal Andhra. The corresponding odds ratio indicates that if the income per acre decrease by a ₹1000/- leads to there may be 74.61 per cent lower the likelihood of chance for going to be a distressed situation than their counterparts (the farmer becoming non-distressed) and vice-versa in the total study area.

With regard to area i.e. irrigated and rainfed, the variable “income per acre ( $X_6$ )” is significant at 5 per cent probability level in both the areas, the odds ratio indicates that if the income per acre decreased by a ₹1000 leads to there may be 34.09 and 83.12 per cent respectively lower the likelihood of chance for going to be a distressed situation than their counterpart (the farmer becoming non-distressed)and vice-versa.

#### Agricultural Expenditure Per Acre ( $X_5$ )

The estimated coefficient of the variable “Expenditure per acre ( $X_5$ )” is turned out to be statistically significant at 1 per cent probability level with expected positive sign. The corresponding odds ratio indicates that if the value of

expenditure per acre increased by a ₹1000/- leads to there may be 20.7 per cent higher the likelihood of chance for going to be a distressed situation than the counterpart (the farmer becoming non-distressed) and vice-versa in the total study area.

With regard to area that is, irrigated and rain fed, the variable “Expenditure per acre ( $X_5$ )” is significant at 5 per cent probability level in both the areas, the odds ratio indicates that if the “Expenditure per acre” increases by a ₹1000 leads to there may be 34.09 and 83.12 per cent respectively higher the likelihood of chance for going to be a distressed situation than the counterpart (the farmer becoming non-distressed)and vice-versa.

#### Warehouse Facility ( $X_9$ )

The estimated coefficient of the variable “Warehouse facility ( $X_9$ )” is statistically significant at 10 per cent level with negative sign in the total study area (North Coastal Andhra). The corresponding odds ratio indicates that if the farming community having warehouse facility is decreased by 1 per cent leads to there may be 0.046 times lower the likelihood of chance for going to be distressed situation than the counterparts (the farmer becoming non-distressed) and vice-versa.

With regard to area that is, irrigated and rainfed area, the variable “Warehouse facility ( $X_9$ )” is not statistically significant even at 10 per cent probability level (Table 2).

#### Indebtedness per Acre ( $X_{10}$ )

The estimated coefficient of the variable “Indebtedness per acre ( $X_{10}$ )” is turned out to be statistically significant at 10 per cent probability level with expected positive sign. The corresponding odds ratio indicates that if the outstanding debt per acre increases by

**Table 2: Results of logistic regression model-Irrigated area**

Independent Variable	Coefficient	Standard error	Z value	P-value	Odds ratio
Constant	2.718905	4.196107	0.65	0.517	-
Age of the head of the household ( $X_1$ )	0.0172936	0.0680275	0.25	0.799	1.017444
Education ( $X_2$ )	3.138978	2.548689	1.23	0.128	23.08027
Dependency rRatio ( $X_3$ )	-4.186001***	2.340411	-1.79	0.074	0.015207
Agricultural income per acre ( $X_4$ )	-0.0006594**	0.003022	-2.18	0.029	0.9993409
Agricultural expenditure per acre ( $X_5$ )	0.0005953**	0.0002991	1.99	0.047	1.000595
Income from livestock ( $X_6$ )	0.000154	0.000163	0.94	0.345	1.000154
Type of area ( $X_7$ )	2.88218	4.13012	0.70	0.485	17.85316
Source of borrowing ( $X_8$ )	-7.451005	18.93595	-0.39	0.694	0.0005809
Warehouse facility ( $X_9$ )	0.0000575***	0.0000332	1.73	0.084	1.000057
Indebtedness per acre ( $X_{10}$ )	2.718905	4.196107	0.65	0.517	-
Number of observations	= 50				*indicates significant at 1 per cent level
LR Chi-Square (11)	= 52.29				**indicates significant at 5 per cent level
Prob> Chi-square	= 0.0000				***indicates significant at 10 per cent level
Pseudo $R^2$	= 0.7544				
Log likelihood	= - 8.5103299				

<sup>1</sup>In order to get this value one has to multiply the value of odds ratio with thousand, since we are talking about the effect of a thousand rupees change on the chance for committing for suicide. Then we have to multiply this value again with hundred since we are expressing the chance in per centile terms. If we do this exercise we can get the value. The same procedure has been followed to get the values mentioned in the above text.

**Table 3: Results of logistic regression model-Rainfed area**

Independent Variable	Coefficient	Standard error	Z value	P-value	Odds ratio
Constant	5.914467	5.044626	1.17	0.241	-
Age of the head of the household (X <sub>1</sub> )	-0.0532491	0.0969042	-0.55	0.583	0.9481438
Education(X <sub>2</sub> )	0.9393391	1.326692	0.71	0.479	2.55829
Dependency rRatio (X <sub>3</sub> )	-0.6550618	2.365222	-0.28	0.782	0.51941
Agricultural income per acre (X <sub>4</sub> )	-0.0001688**	0.0000694	-2.43	0.015	0.9998312
Agricultural expenditure per acre (X <sub>5</sub> )	0.0001113***	0.0000634	1.76	0.079	1.000111
Income from livestock (X <sub>6</sub> )	0.0000115	0.000032	0.36	0.719	1.000011
Type of area(X <sub>7</sub> )	-2.367946***	1.221709	-1.94	0.053	0.0936729
Source of borrowing (X <sub>8</sub> )	-6.305935	8.894484	-0.71	0.478	0.0018254
Warehouse facility (X <sub>9</sub> )	0.0000378	0.0000684	0.55	0.581	1.000038
Indebtedness per acre (X <sub>10</sub> )	5.914467	5.044626	1.17	0.241	-
<i>Number of observations</i> = 50					<i>*indicates significant at 1 per cent level</i>
<i>LR Chi-Square (11)</i> = 43.56					<i>**indicates significant at 5 per cent level</i>
<i>Prob&gt; Chi-square</i> = 0.0000					<i>***indicates significant at 10 per cent level</i>
<i>Pseudo R<sup>2</sup></i> = 0.6403					
<i>Log likelihood</i> = - 12.235742					

a 1000/- leads to there may be 1.01 times higher the likelihood of chance for going to be a distressed situation than the counterpart(the farmer becoming non-distressed) and vice-versa in the total study area.

With regard to area i.e. irrigated and rainfed, the variable “indebtedness per acre (X<sub>10</sub>)” is statistically significant at 10 per cent probability level in irrigated area with positive sign. The corresponding odds ratio indicates that if the outstanding debt per acre increases by a ₹1000 leads to there may be 1.01 times higher the likelihood of chance for going to be a distressed situation than the counterpart(the farmer becoming non-distressed) and vice-versa in the total study area. In the rainfed area the variable is not statistically significant even at 10 per cent probability level. It is observed from the field survey most of the farming community are not psychologically ready to do cultivation with efficiency, they are doing in customary only.

**CONCLUSIONS**

Based on the analysis carried out and field survey, it can be observed that the categorical variables which

influences the farmer's distress are quite different between irrigated and rainfed areas in North Coastal Andhra region. These factors suggest that planning of MNREG works in the hand of local bodies, this will help to increase the supply of cultivated labour at the time of farming. It also suggests that strengthen the co-op societies and increase the credit facility in the right time. To avoid the volatility in agriculture, introduction of the crop insurance and spreading awareness among the cultivators about the agriculture insurance would benefit. It's time for encouraging the Agriculture Scientist Subhash Palekar's Zero Budget Spiritual Farming or Nature Farming.

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## **Income of Punjab Farmers-A Thorough Analysis**

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### **ABSTRACT**

The objective of present paper is to analyze the income pattern of the marginal, small, medium and large farmers in rural Punjab. For this analysis, the state of Punjab has been divided into three zones on the basis of levels of agricultural productivity, i.e. low, medium and high productivity zone. On the basis of this criterion, it is deemed fit to select, Gurdaspur district from the low productivity zone, Ferozepur district from the medium productivity zone and Fatehgarh Sahib district from the high productivity zone. The study has concluded that average household income and per capita income is directly related with the agricultural productivity and farm-size. Since there is positive relationship between farm-size and farm business income, this makes a strong case for land reforms in favour of the marginal and small farmers apart from other measures helpful in increasing their income. Suggestions have also been made that can contribute in doubling the income of farmers by 2022.

### **Keywords**

Agricultural productivity, farmers' income, green revolution, income security, marginal and small farmers

### **JEL Codes**

O15, P32 Q10, Q12, Q16, Q18

### **INTRODUCTION**

By announcing the target of doubling the farmers' income by 2022, the Hon'ble Finance Minister, Mr. Arun Jaitley, in his Union Budget Speech 2016-17, had highlighted the need to think beyond 'food security' of the country to focus on 'income security' of the farmer (NABARD, 2016). During the period of Green Revolution and thereafter, more focus was on increasing agricultural production and productivity rather than enhancing the income of the farmers. All earlier approaches of the Government of India (GoI) related to agriculture were farm centric instead of farmer centric. This is one of the reasons that our farmers are in distress despite the remarkable achievement in food production. With the announcement of the Government of India (GoI) for achieving the objective of doubling farmers' income by 2022, all the States are now concerned to adopt various methods and measures to double the income of their farmers by 2022. The state of Punjab is not an exception in this case.

According to the Census of India (2011), 62.52 per cent population of the state of Punjab is residing in rural

areas. The population comprises landless, marginal, small, medium and large farm-size categories. The main occupation of the rural populace of Punjab is agriculture. The state has witnessed a tremendous increase in the agricultural production during the Green Revolution period, mainly due to healthy mix of institutional and technological factors. Agrarian economy, consolidation of landholdings, reclamation of new agricultural lands, development of irrigation, use of biochemical inputs comprising high yielding variety seeds, chemical fertilizers, insecticides and mechanical inputs were among the important factors which helped Punjab agriculture in making rapid strides. Green Revolution sustained till the eighties, after which the agricultural production in the state showed the signs of stagnation (Singh *et al.*, 2012). Afterwards farmers are facing economic distress and committing suicides. There is no end to their agony. The Punjab peasantry especially the small farmers could not afford farm investment from their own savings to transform traditional agriculture into scientific farming (Singh & Toor, 2005). Further, the new economic policy advocates withdrawal of the state from

the economic sphere by leaving it to the logic of market forces. Leaving the agricultural sector to the vagaries of free market could prove disastrous (Jodhka, 2006). The subordination of cultivators to market and capital forces without safety net to support them in times of crop loss, accounts for the devastation of rural communities (Vasavi, 1998). As a consequence, per hectare net return is declining and this is the real crisis of Punjab agriculture. There is need of some concrete efforts to help the farmers.

### OBJECTIVES OF THE STUDY

The present study is an endeavor to discuss levels and pattern of income of different farm-size categories of rural Punjab. More specifically, the aim is:

- a. to estimate per household and per capita income of farmers,
- b. to analyse the composition of income of different farm-size categories,
- c. to analyse the income distribution among different farm-size categories, and
- d. to suggest the ways and means that can facilitate doubling the income of farmers.

### METHODOLOGY

For the analysis of income pattern of the marginal, small, medium and large farmers of Punjab, the whole State on the basis of levels of agricultural productivity has been divided into three zones, viz. low, medium and high productivity zones. Agricultural productivity is estimated by aggregation of the output of ten major crops of the state for the year 2013-14 (GOP, 2014). On the basis of this criterion, it was decided to select Gurdaspur district from the low productivity zone, Ferozepur district from the medium productivity zone and Fatehgarh Sahib district from the high productivity zone. On the basis of random sampling method one village from each development

block of the selected districts has been selected. Thus, in all, twenty-two villages were selected for the survey. These include eleven villages from Gurdaspur district, six villages from Ferozepur district and five villages from Fatehgarh Sahib district. Taking into consideration the number of variables and the number of households with positive response, a sample of 10 per cent of total farm households comprising marginal farmers, small farmers, medium farmers and large farmers has been taken for the survey. Out of 22 villages, 490 farm household have been surveyed in total. Out of 490 farm households, 93 from Fatehgarh Sahib, 202 from Ferozepur and 195 from Gurdaspur have been surveyed. Out of total 490 households, 193 are from marginal farm-size category, 142 from small farm-size category, 92 from medium farm-size category and 63 from large farm-size category. The survey was conducted during the year 2015.

### RESULTS AND DISCUSSION

#### Household Income

The mean values of income earned from various sources by the various categories of farmers of Punjab are given in Table 1. The results show that an average sampled farm household earns ₹222763.76 per annum in the rural areas of Punjab.

There are considerable variations in the levels of income earned by the marginal, small medium and large farm-size categories. It is ₹73792.49, ₹161988.38, ₹255404.78 and ₹255404.78 for the marginal, small, medium and large farm-size categories respectively. A positive relationship between farm-size and levels of income can be observed from the table. It is evident that as the farm-size increases, the average income of the farm households also increases. The annual income of an average large farm household is found to be 3.46 times the

Table 1: Levels of income of sampled farming households

Source of income	(₹ per annum)				
	Marginal farmers	Small farmers	Medium farmers	Large farmers	All categories
Farm business income	55409.07	129219.37	212473.91	654142.86	183268.78
Income from dairying*	6996.89	10954.23	10663.04	29450.79	11718.98
Income from sale of livestock	3502.59	7510.56	10271.74	22222.22	8341.84
Income from hiring out labour in agriculture	875.65	1633.80	0.00	0.00	818.37
Income from hiring out machinery and equipment	549.22	1320.42	5391.30	19952.38	4176.53
Income from sale of irrigation water	549.22	750.00	897.50	1047.62	736.88
Income from leased out land	165.80	1577.46	3130.43	0.00	1110.2
Income from salaries	2536.79	2952.11	4347.83	9417.46	3881.84
Income from pensions	1331.61	2126.76	2717.39	4603.17	2242.86
Income from other sources**	1875.65	3943.66	5511.63	27619.05	6467.49
<b>Total income</b>	<b>73792.49</b>	<b>161988.38</b>	<b>255404.78</b>	<b>255404.78</b>	<b>222763.76</b>

Source: Field Survey, 2015.

\*Net income is taken

\*\*It includes income from hiring out labour in non-agricultural sector and income from small businesses like shop keeping.

annual income of the marginal farm household.

Farm business income is the most important component of household income followed by income from dairying and income from sale of livestock. The average income from these three sources is found to be ₹183268.78, ₹11718.98, and ₹8341.84 respectively. The results clearly show that in absolute terms the sources of income show a similar pattern across the marginal, small, medium and large farm-size categories except income from hiring out labour in agriculture. There is no income from hiring out labour for the medium and large farm-size categories because of their better off economic condition than the marginal and small farm-size categories. The marginal farm-size category earns an income of ₹875.65 from this source and the small farm-size category earn ₹1633.80. This phenomenon indicates the fact that farm business income of the marginal and small farm-size categories is not sufficient to meet their requirements and farmers of these categories earn some income from hiring out labour in agriculture.

#### Pattern of income

The relative shares of income of various sources of farm households are given in Table 2. The results show that by virtue of being farmers the main source of income in the case of an average sampled farm household is the farm business income. On an average, 82.27 per cent of the total income consists of farm business income. This proportional share is directly related with farm-size. The marginal, small, medium and large farm-size categories received 75.09 per cent 79.77 per cent, 83.19 per cent and 85.12 per cent of their average annual household income from farm business income respectively. The second important source of income in the case of an average sampled farm household is income from dairying (milk and milk products). 5.26 per cent of the total income consists of income from this source. The percentage share of income from this source stands at 9.8 for the marginal farmers and 6.76 for the small farmers, 4.17 for the

medium farmers and 3.83 for the large farmers.

Income from the sale of livestock ranks third in the case of an average sampled farm household. Income from this source is 3.74 per cent of the total income of an average sampled farm household. From this source of income, the marginal, small, medium and large farm-size categories earn 4.75, 4.64, 4.02 and 2.89 per cent respectively. The fourth place in the income pattern of all farm-size categories goes to the income from other sources. An average sampled farm household earns 2.90 per cent of the total income from this source. The relative share of this source in the total household income is 2.54, 2.43, 2.16, and 3.59 per cent for the marginal, small, medium and large farmers respectively.

The next important source of income is income from hiring out machinery and equipment for agriculture. The proportional share from this source is 1.87 per cent for an average sampled farm household. The marginal, small, medium and large farm-size categories earn 0.74, 0.82, 2.11 and 2.60 per cent from this source of income. The relative share of income from hiring out agricultural machinery and equipment shows a positive relationship with the farm-size. Income from salaries appears at the sixth rank. An average sampled farm household earns 1.74 per cent of the total income from this source. The relative share of this source in the total household income is 3.44, 1.82, 1.70, and 1.23 per cent for the marginal, small, medium and large farmers respectively. Income from pensions stands at seventh rank. An average sampled farm household earns 1.01 per cent of the total income from this source. The marginal, small, medium and large farm-size categories earn 1.80, 1.31, 1.06, and 0.60 per cent from this source of income. The results reveal that the relative share of income from salaries and pensions shows a negative relationship with farm-size.

Income from leased out land ranks eighth in the case of an average sampled farm household. Income from this source is 0.50 per cent of the total income of an average

Table 2: Pattern of income of sampled farmers on the basis of category

Source of income	(Percentage of total income)				
	Marginal farmers	Small farmers	Medium farmers	Large farmers	All categories
Farm business income	75.09	79.77	83.19	85.12	82.27
Income from dairying*	9.48	6.76	4.17	3.83	5.26
Income from sale of livestock	4.75	4.64	4.02	2.89	3.74
Income from hiring out labour in agriculture	1.19	1.01	0.00	0.00	0.37
Income from hiring out machinery and equipment	0.74	0.82	2.11	2.60	1.87
Income from sale of irrigation water	0.74	0.46	0.35	0.14	0.33
Income from leased out land	0.22	0.97	1.23	0.00	0.50
Income from salaries	3.44	1.82	1.70	1.23	1.74
Income from pensions	1.80	1.31	1.06	0.60	1.01
Income from other sources**	2.54	2.43	2.16	3.59	2.90
<b>Total income</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>

Source: Field Survey, 2015.

\*\*It includes income from hiring out labour in non-agricultural sector and income from small businesses like shop keeping

sampled farming household. From this source of income, the marginal, small and medium farm-size categories earn 0.22, 0.97, and 1.23 per cent respectively. There is no income from this source in case of large farm-size category. The study reveals the fact that the marginal and small farmers sometimes hire out some part of their small holdings because of many reasons such as lack of irrigational facilities, immediate need for cash, etc.

Income from hiring out labour in agriculture is just 0.37 per cent for an average farming household. It is due to the impact of socio-cultural factors the farmers generally hesitate to hire out in agriculture. The farmers hire out labour in agriculture because of their compulsions arising out of low levels of household income. From this source of income, the marginal and small farm-size categories earn 1.19 and 1.01 per cent respectively.

The last rank goes to the income from the sale of irrigation water. The proportional share from this source is only 0.33 per cent for an average sampled farm household. From this source of income, the marginal, small, medium and large farm-size categories earn 0.74, 0.46, 0.35, and 0.14 per cent respectively. The study revealed the fact that the marginal and small farmers do not own machinery according to their own requirements. Generally they lease in machinery for different agricultural operations. However, they try to enhance their household income by leasing out agricultural equipment. The last rank goes to income from leased out land. An average sampled farm household earns merely 0.88 per cent of the total income from this source. The relative share of this source in the total household income is 0.40 and 1.17 per cent for the marginal and small farmers respectively. The field survey revealed the fact that the marginal and small farmers sometimes hire out some part of their small holdings because of many reasons such as lack of irrigational facilities, immediate need for

cash etc. The relative shares of income from hiring out agricultural equipment and leased out land show a positive relationship with farm-size.

#### Per capita income

In the preceding discussion, the income levels and pattern of the marginal and small farm-size categories in the rural Punjab have been analysed. The average family size of the sampled households is 5.00. The average family size of the marginal, small, medium and large farm-size categories is 4.94, 4.98, 4.97 and 5.24 respectively. Since the family size across the marginal, small, medium and large farm-size categories varies, it becomes relevant to look into the per capita income levels across the different farm-size categories. The data pertaining to the per capita income earned by the marginal, small, medium and large farm-size categories in the rural areas of Punjab is given in Table 3. An average sampled farm household earns per capita income of ₹44552.75 annually. However, there are differences in the per capita income levels of the different farm-size categories. For example, per capita income of the marginal farm-size category is ₹14937.75 and it is ₹32527.79 annually for the small farm-size category. The per capita income of the medium farm-size category is ₹51389.29 and it is ₹146651.82 annually for the small farm-size category. The per capita income of the large farm-size category is 9.81 times the per capita income of the marginal farm-size category. It is 4.50 times the per capita income of the marginal farm-size category and 2.85 times the per capita income of the medium farm-size category.

#### Distribution of Income

The pattern of distribution of income among families and population of the marginal, small, medium and large farm-size categories taken together as a whole have been worked out by taking cumulative percentages of per household and per capita income for each farm-size

**Table 3: Per capita income of sampled farmers**

Source of income	(₹ per annum)				
	Marginal farmers	Small farmers	Medium farmers	Large farmers	All categories
Farm business income	11216.41	25947.66	42751.29	124836.42	36653.76
Income from dairying*	1416.38	2199.64	2145.48	5620.38	2343.79
Income from sale of livestock	709.03	1508.14	2066.75	4240.88	1668.36
Income from hiring out labour in agriculture	177.26	328.07	0.00	0.00	163.67
Income from hiring out machinery and equipment	111.18	265.14	1084.77	3807.71	835.30
Income from sale of irrigation water	111.18	150.60	180.58	199.93	147.37
Income from leased out land	33.56	316.76	629.87	0.00	222.04
Income from salaries	513.52	592.79	874.81	1797.23	776.36
Income from pensions	269.56	427.06	546.76	878.47	448.57
Income from other sources**	379.69	791.90	1108.98	5270.81	1293.49
<b>Total income</b>	<b>14937.75</b>	<b>32527.79</b>	<b>51389.29</b>	<b>146651.82</b>	<b>44552.75</b>

Source: Calculated from Table 1

\*Net income is taken

\*\*It includes income from hiring out labour in non-agricultural sector and income from small businesses like shop keeping

category after arranging the same in the ascending order. Gini coefficients have also been calculated to justify the pattern of distribution. Gini coefficient conveys better distribution if it is nearer to zero and worse distribution if it is nearer to unity.

#### Household income distribution

The distribution of income among the sampled farmers in the rural areas of Punjab has been shown in Table 4. The bottom 10 per cent farm households share only 1.94 per cent of the total income earned by all the sampled farm households. On the other hand, the top 10 per cent farm households appropriate 36.46 per cent of the total income of all the sampled farm households. This is about 18.79 times the income shared by the bottom 10 per cent farming households. A clear contrast is obvious from the fact that the bottom 60 per cent farm households account for about 27 per cent of the total income, whereas only 10 per cent top households account for slightly more than 36 per cent to the total income earned by all the sampled farming households.

Almost a similar picture can be seen from the different farm-size categories. Whereas the bottom 10 per cent of the marginal farming household claim 4.51 per cent of the total household income, the corresponding figure for the small, medium and large farm households stands at 6.98, 8.00, and 7.31 per cent respectively. On the other hand, the top 10 per cent households appropriate 18.45, 15.07, 15.20, and 15.49 per cent for the marginal, small, medium and large farming households respectively. This shows the fact that the income concentration among the marginal farming households is slightly greater than that of the small, medium and large farming households. Gini coefficients also support this evidence. These are 0.20 and 0.12, 0.12 and 0.14 for the marginal, small, medium and large farmers respectively. Gini coefficient for all the sampled farm households is of the order of 0.46, indicating a highly skewed distribution of income. The results reveal that concentration coefficients in case of

small and medium farmers are same.

#### Distribution of Per Capita Income

Distribution of per capita income is shown in Table 5. The results show that there are large-scale inequalities in the distribution of per capita income in comparison to the inequalities in the household income distribution. The bottom 10 per cent of all the sampled farm households share only 1.79 per cent of the total income, whereas the top 10 per cent secure as high as 38.07 per cent of the total income.

The medium farm households depict the worst distribution. The bottom 10 per cent of the medium farmers claim only 5.09 per cent of the total income, while the top 10 per cent appropriate 19.70 per cent of the total income. The bottom 10 per cent of the marginal farmers claim only 4.25 per cent of the total income, while the top 10 per cent appropriate 18.42 per cent of the total income. The bottom 10 per cent of the small farmers claim only 5.12 per cent of the total income, while the top 10 per cent appropriate 19.39 per cent of the total income. The bottom 10 per cent of the large farmers claim only 4.59 per cent of the total income, while the top 10 per cent appropriate 18.77 per cent of the total income. There are marginal differences in the share of top 10 per cent and bottom 10 per cent among the small and medium farm-size categories. The Gini coefficients are also higher than those of per household basis among all the farm-size categories. On an overall basis, the Gini coefficient is greater for per capita income vis-à-vis per household income. This shows that the concentration of per capita income is higher than per household income.

#### CONCLUSIONS AND POLICY IMPLICATIONS

It is concluded from the above analysis that an average sampled farm household earns annually ₹222763.76 in the rural Punjab. Farm business income is the most important component of household income. An average sampled farm household earns per capita income of ₹36653.76 annually. The study reveals a positive

Table 4: Distribution of household income of sampled farmers

Cumulative percentage of households	Cumulative percentage of household income of				
	Marginal farmers	Small farmers	Medium farmers	Large farmers	All categories
10	4.51	6.98	8.00	7.31	1.94
20	10.78	14.98	15.42	13.81	4.88
30	18.08	23.15	23.42	21.82	8.46
40	26.48	32.02	32.01	30.19	13.13
50	35.82	41.49	41.12	40.60	19.11
60	45.82	51.49	50.95	49.84	26.41
70	56.51	61.88	61.64	59.57	35.00
80	67.99	72.96	72.81	71.56	45.59
90	81.55	84.93	84.80	84.51	63.54
100	100.00	100.00	100.00	100.00	100.00
<b>Gini coefficient</b>	<b>0.20</b>	<b>0.12</b>	<b>0.12</b>	<b>0.14</b>	<b>0.46</b>

Source: Field Survey, 2015

**Table 5: Distribution of per capita income of sampled farmers**

Cumulative percentage of households	Cumulative percentage of household income of				
	Marginal farmers	Small farmers	Medium farmers	Large farmers	All categories
10	4.25	5.12	5.09	4.59	1.79
20	10.43	11.64	11.36	10.61	4.63
30	18.14	18.81	18.10	17.48	8.16
40	26.41	26.56	25.83	24.96	12.54
50	35.41	34.88	34.18	33.42	18.07
60	45.34	43.93	43.57	42.74	24.75
70	56.10	54.21	54.02	53.13	33.25
80	67.91	65.86	65.76	66.33	44.56
90	81.58	80.61	80.30	81.23	61.93
100	100.00	100.00	100.00	100.00	100.00
<b>Gini coefficient</b>	<b>0.21</b>	<b>0.22</b>	<b>0.22</b>	<b>0.23</b>	<b>0.48</b>

Source: Field Survey, 2015

relationship between farm-size and income levels, that is, as the farm-size increases, the average income of the sampled farm households also increases.

The study has revealed that there is positive relationship between farm-size and farm business income. This makes a strong case for land reforms in favour of the marginal and small farmers apart from other measures helpful in increasing their income. To double the income of the farmers, following measures can be congenial:

1. Prime Minister's seven-point Strategy for doubling farmers' Income by 2022 should be strictly followed and implemented by the State government. The strategy focuses on irrigation with per drop-more crop; quality seed and soil health; investments in warehousing and cold chains; value addition through food processing; creation of a national farm market; new revolutionary crop insurance scheme to mitigate risks at affordable cost; and promotion of ancillary activities like poultry, beekeeping, and fisheries.
2. Diversification can be a major game changer. Diversification is mostly about high value crops. It can be of three types, viz. product (high value enterprises), process (precision farming), and time diversification (delinking from seasonality). Bumper production of crops can lead to a sharp fall in prices. This can be prevented by changing seasonality.
3. To reduce post-harvest losses in high value crops is an important issue. Wastages in fruits, vegetables, fish, etc. need to be reduced by creating storage, cold chain, and market infrastructure. States need to be brought on board for addressing the above issues. The exercise

should start at the block level and then go up to the district and state level.

4. Technology needs to be taken seriously. Only 0.4 per cent of agriculture GDP is spent on technology. At least 1 per cent of agro-GDP needs to be spent on technology. Agenda for agriculture research needs to be prioritized viz. climate change, cost of production, and extension system. It has been observed that farmers who use information from extension services have 80 per cent higher net income. Access to information and how much is used is very important for improving production and productivity (NABARD, 2016).
5. Cooperative credit institutions have an important role to play in doubling of farmers' income. There is a need to strengthen and professionalize District Cooperative Central Banks (DCCBs) and Primary Agricultural Credit Societies (PACS).

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## **A Status Analysis of Export-Import of Livestock Sector: A Key Sector for Multiplying Rural Farm Income in India**

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### **ABSTRACT**

*Livestock makes multi-faceted contribution to socio-economic development of rural areas. Due to this inelastic absorptive capacity for labour in the other economic sectors, livestock sector has the scope for generating more employment opportunities, especially for the marginal and small farmers and also landless labourers who own around 70 percent of the country's livestock. The analysis of exports and imports of the livestock products thus, throws light on the national income which is ultimately owned by these farmers. The exercise carried revealed that-(i) India exported the highest quantity of buffalo meat (69.50 per cent), (ii) significant growth rates were recorded in the sheep and goat meat (3.88 per cent), animal casings (5.24 per cent) and processed meat (4.09 per cent), (iii) in the case of imports, the dairy product ranks 1<sup>st</sup> in total imports of the country, (iv) natural honey recorded the highest growth (36.12 per cent per annum) in the export, (v) the trade balance of the country showed the trade surplus situation in case of imports and exports of livestock products over the period of six years. The exports and imports of livestock products analysis showed that the Indian exports are on positive move which can be considered in favour of the livestock sector which is comprises of mainly the rural small and marginal farmers. If the benefit of exports is properly streamlined, the incomes of these farmers will definitely get increased to a considerably high level approaching to getting doubled in near future.*

### **Keywords**

Export, farmers, import, income, livestock

### **JEL Codes**

C82, C87, F40, P44, Q13, Q18

### **INTRODUCTION**

Livestock keeping has been since long, an integral part of Indian farming. In mixed farming system, livestock is kept for various reasons such as food, security, income, employment, manure, draught, fuel, savings, and socio-cultural objectives and as insurance for urgent cash needs. The capital asset function of livestock is important in areas lacking formal insurance and credit mechanism. Keeping livestock is an insurance against events requiring (unexpected) appreciable cash outlays, such as a wedding, funeral, hospitalization of a household members, renovation of the house, education as expenses for children and other social obligations for religious functions or symbolic exchange in hospitality, etc. (Moll, 2005). Livestock is important both as savings and investments for the poor household and provides security or insurance through multiple ways in different production systems (Kitalyi *et al.*, 2005). Livestock production is likely to undergo significant changes in

terms of population adjustment, production efficiency, commercialization, and intensification to respond to the increasing demand for animal based food products (BIRTHAL & Parthasarathy, 2004).

At the national level livestock sector is playing an important role in terms of employment, income, export and source of drought power. The contribution in national income is continuously increasing in India. The livestock products are providing income and employment opportunities and security to rural household. The livestock sector has forward and backward linkage. Farmers regularly sell high value animal products and purchase other food and non-food items from market. The livestock population in India is continuously increasing since independence. Livestock sector is significantly contributing to the national economy and the growth rate is increasing. Due to liberalization and globalization policies, the demand for livestock products has increased. The total livestock population of India makes up a huge

number of 512.05 million and India has the cattle population 190.90 million, constituting 108.7 million buffaloes, 65 million sheep and 135.17 million goats and 729.2 million total populations (Livestock Census, 2012). Today, the economic contribution of livestock sector is more than that of crop and fisheries sector. During the year 2014-15, the livestock sector alone contributed 24.7 per cent in terms of value of output to agriculture and allied sector at current prices and the overall contribution of livestock sector in total GDP is nearly 2.2 per cent at current prices. With all these facts and figures, this one of the core and pivotal sector in the country like India which will be considered primarily in our planning and remain the flesh point of policy formulation right now if as announced by our PM to double the income of farmers by 2022. With the view in consideration, an attempt has been made to analyse the present status of livestock sector in our economy with its exports and imports.

#### METHODOLOGY

The study is based on the time series data obtained from various published sources viz: Reports of Planning Commission published by Government of India, Annual Reports on exports of products by APEDA, etc. Some other reports viz; Statistical Abstract of Maharashtra, Socio-economic Reviews, etc., were also used for getting relevant information.

The data obtained on livestock production and import and export of livestock product viz. milk, meat, egg etc. for the period from 1991-92 to 2014-2015 were used for the estimation of compound growth rates. The data were computerized to have compound growth rates in livestock products and their exports at three sub-periods are as under.

Periods	Years included
Period - I	: 1991-92 to 2002-03
Period - II	: 2004-05 to 2014-15
Overall Period:	1992-93 to 2014-15

This became useful for studying the changes in the livestock products and their export and import during the above period in Maharashtra state.

#### Compound growth rate

The compound growth rates were worked out by fitting exponential function of the following type to the data for three periods explained above.

$$Y = ab^t$$

$$\text{Log} Y = \text{log } a + t \text{ log } b$$

Where,

Y = Livestock production (milk, meat, egg in tonnes)

a = Intercept

b = Regression coefficient

t = Time period in years

Finally, the annual rate of the compound growth in the livestock products and their exports was worked out by using the formula,

$$r = (\text{Antilog } b - 1) \times 100$$

Where, r = Compound Growth Rate

The significance of the estimated compound growth

rates was tested with the help of students't-test.

## RESULTS AND DISCUSSION

### Exports of livestock products from India

As already seen in the beginning, livestock sector is significantly contributing to the national economy and the growth rate is increasing. Due to liberalization and globalization policies, the demand for livestock products has increased. The exports of livestock products is playing vital role in increasing the income of the rural community in the country. The changes in the exports of livestock products from India are depicted in Table 1. India exports the various products, viz; (i) buffalo meat, (ii) poultry products, (iii) sheep/goat meat, (iv) dairy products, (v) animal casings, (vi) natural honey and (vii) processed meat, etc.

The total exports during the year 1991-92 were 166597.38 MT, for which the total export value was ₹251.98 crore. The total exports increased by 106.48 MT and 1174.28 MT during the year 2002-03 and 2014-15, respectively over the base year. The export value also increased by ₹543.97 crore and ₹12656.44 crore during year 2002-03 and 2014-15, respectively over the base year. The export of buffalo meat was highest during the year 2014-15 and which was 14, 75,256 MT, which accounted 63.54 per cent share in the total exports of livestock products in the country. Due to this, there was a 90 per cent increase in the total exports value, the increase in buffalo meat by 266.06 and 1714.2 per cent, during the year 2002-03 and 2014-15, respectively over the base year.

In the case of poultry products, the export was 74,484.32 MT during the year 1991-92. It declined during the year 2002-03 by 66.51 per cent and increased by 6, 47.40 MT during the year 2014-15. The value for export of poultry products also increased over the base year by ₹1380 crore and ₹6315.66 crore, respectively during year 2002-03 and 2014-15, respectively. The total sheep and goat meat exports was 7,619.99 MT during year 1991-92, which increased by 23,611.54 during year 2014-15. But during the year 2002-03, the exports of sheep and goat declined by 34.94 per cent over the base year. This might be due to decline in population of sheep and goat. The values for exports of products have shown fluctuations over the year.

The dairy products are the main export products from the country, due to the highest milk production. The export of dairy products was 2,643.42 MT during the year 1991-92. The per cent share of dairy products during the year 1991-92 was 1.59 per cent, it increased by 4.21 and 3.10 per cent during the years 2002-03 and 2014-15, respectively.

There was a significant increase in the value for export of dairy products; the value during year 2014-15 for Dairy products was ₹10624.19 crore. The animal casings are the intestines of the animals. They are exported in the small quantity. The export of animal casings during year 1991-92 was 3, 25.48 MT which received the value of ₹6.9

**Table 1: Exports of livestock products from India**

Livestock Products	Units	Period			(Quantity in MT and value in ₹ Crore)	
					Per cent change over base year (1991-92)	
		1991-92	2002-03	2014-15	2002-03	2014-15
Buffalo meat	Quantity	81331.27 (48.81)	297727.71 (84.90)	1475526.00 (68.54)	266.06	1714.21
	Value	188.96 (75.00)	1304.82 (78.20)	29282.58 (90.00)	590.52	15396.70
Poultry products	Quantity	74484.32 (44.71)	24943.18 (7.11)	556698.80 (25.86)	-66.51	647.40
	Value	10.15 (4.02)	150.22 (9.00)	651.19 (2.00)	1380	6315.66
Sheep and goat meat	Quantity	7619.99 (4.58)	4957.74 (1.41)	23611.54 (1.09)	-34.94	209.86
	Value	32.48 (12.89)	39.8 (2.38)	828.11 (2.59)	22.53	2449.59
Dairy products	Quantity	2643.42 (1.59)	14775.3 (4.21)	66424.37 (3.10)	458.95	2412.81
	Value	11.24 (4.46)	100.46 (6.03)	1205.4 (3.70)	793.77	10624.19
Animal casings	Quantity	325.48 (0.19)	923.27 (0.26)	260.15 (0.012)	183.66	-20.07
	Value	6.9 (2.73)	15.36 (0.92)	19.33 (0.06)	122.61	180.14
Natural honey	Quantity	0.12 (0.0007)	6646.59 (1.90)	29578.56 (1.38)	5538725.00	24648700.00
	Value	1.12 (0.45)	52.9 (3.18)	535.1 (1.65)	5178.00	53398.00
Processed meat	Quantity	192.78 (0.12)	669.48 (0.20)	406.11 (0.02)	247.27	110.65
	Value	1.13 (0.46)	4.8 (0.29)	14.2 (0.043)	324.78	1156.63
Total	Quantity	166597.38 (100.00)	350643.27 (100.00)	2152505.53 (100.00)	106.48	1174.28
	Value	251.98 (100.00)	1668.36 (100.00)	32535.91 (100.00)	543.97	12656.44

Source: [www.apeda.org](http://www.apeda.org)

Figures in the parentheses indicate percentage to total

crore. The export quantity of animal casings was fluctuating over the years. It declined by 20.07 per cent during year 2014-15.

In the case of natural honey, the total export was just 0.12 MT during 1991-92; however, a tremendous increase in export of natural honey was noticed in subsequent years due to weak base year export. The export of processed meat during the year 1991-92 was 192.78 MT, which increased by 406.11 MT during year 2014.15. This showed the overall increase in export of processed meat of 247.27 and 110.65 per cent during the year 2002-03 and 2014-15 over the base year. Thus, the exports of country showed positive increase over base the year.

#### Imports of livestock products in India

Though India remained the highest producer of milk

in the world, it was also seen that the highest imports of total livestock products were there during the year 2011-12 which was about 74460.18 MT, which incurred the value of ₹1325.49 crore (Table 2). In the case of dairy products, the highest imports were during the year 2011-12 which was 70699.9 MT, which contributed 94.94 per cent share in the total import of livestock products in the country.

It was observed that the imports of dairy products increased by 683.91 and 48.76 per cent during year 2011-12 and 22015-16, respectively over the base year. The albumin which is present in egg, was imported from other countries to the tune of 235.66 MT during the year 2008-09, which increased by 1,829.8 MT during the year 2015-16 and constituting a share of 10.54 per cent in total

imports. The imports of albumin have increased by 485.99 and 676.44 per cent during the years 2011-12 and 2015-16, respectively.

The case in, which is milk protein, was imported (136.17 MT) from other countries and which contributed 0.99 per cent share in the total imports of country during the year 2008-09. It increased by 788.26 MT during the year 2015-16, contributed 4.33 per cent share in total imports during the year 2015-16. The import of casein however, declined by 2.33 per cent during the year 2011-12, whereas, it again increased by 478.86 per cent during the year 2015-16 over the base year due to increase in milk production.

In case of poultry products, the total import estimated during the year 2008-09 was 265.26 MT and contributed 1.92 per cent share in total imports. It increased by 699.24 MT (i.e. 4.04 per cent) during year 2015-16. There was an increase of 149.46 and 163.06 per cent over the base year during year 2011-12 and 2015-16, respectively. The value of imports have increased by 22.25 and 39.49 per cent during 2011-12 and 2015-16 over the base year.

The imports of other meat was 331.41 MT contributing 2.40 per cent share in total imports during the year 2008-09, which increased by 540.06 MT during year 2011-12. The increase of 62.95 per cent of other meat was observed during the year 2011-12 over the base year. There was a decline in the quantity and value of import by 85.69 and 34.03 per cent, respectively during the years 2011-12 and 2015-16.

In the case of sheep and goat meat, the total import was 19.45 MT during the year 2008-09 increased by 47.43 MT

during year 2015-16. It is seen from the Table 2, that there was decline of 76.22 and 51.16 per cent in the quantity and value of import of sheep and goat meat.

The contribution of natural honey was 20.32 per cent in the total import of livestock products during year 2008-09. From the Table 2, it revealed that there was decline of 61.76 and 45.95 per cent in the quantity and value of import of natural honey over the base year.

In the case of processed meat, the highest import was recorded during the year 2008-09 and which was 967.75 MT, contributing 7.02 per cent share in total import. The overall imports of processed meat have declined by 0.50 and 92.64 per cent during the years 2011-12 and 2015-16, respectively over base year.

#### Growth rates in exports of livestock products

The growth rates in exports of livestock products in India during the period 1991-92 to 2014-15 are depicted in Table 3.

During the Period-I (1991-92 to 2002-03), the growth in total exports of livestock products was to the tune of 9.21 per cent per annum which was highly significant. The highest rate of growth (118.03 per cent) was found in the natural honey followed by dairy products (i.e. 18.64 per cent). Buffalo meat recorded a negative growth rate of 5.09 per cent.

During the Period-II (2003-04 to 2014-15), the growth in total exports was recorded at the rate of 2.98 per cent per annum. The growth in export of buffalo meat was found to be the highest (15.01 per cent per annum). The export of poultry products, animal casings and processed meat had recorded the negative growth at the rates as 8.77,

**Table 3: Growth rates in exports of livestock products from India**

Livestock products	Units	Period-I	Period-II	Overall Period
Buffalo meat	Quantity	12.31***	15.01***	12.91***
	Value	20.00***	33.26***	23.34***
Poultry products	Quantity	2.315	-8.77***	32.76***
	Value	28.70***	7.06***	19.72***
Sheep and Goat meat	Quantity	-5.09*	11.26	3.88**
	Value	-0.53	27.16***	12.08***
Dairy products	Quantity	18.64**	4.28	22.63***
	Value	22.46**	12.73*	29.33***
Animal casings	Quantity	6.36***	-5.87	4.09**
	Value	7.02***	9.63*	5.23***
Natural Honey	Quantity	118.03***	12.29***	36.12***
	Value	60.45***	24.54***	41.13***
Processed meat	Quantity	7.95	-3.29	5.24***
	Value	9.95*	8.27*	10.37***
Total	Quantity	9.21***	2.98*	16.85***
	Value	18.73***	29.42***	22.64***

\*\*\*, \*\*, \* Significant at 1, 5, 10 per cent level

Table 2: Imports of livestock products in India

Livestock products	Units	(Quantity in MT and value in ₹Crore)				
		Period			Per cent change over base year (2008-09)	
		2008-09	2011-12	2015-16	2011-12	2015-16
Dairy products	Quantity	9018.83 (65.48)	70699.9 (94.94)	13417.1 (77.21)	683.91	48.76
	Value	99.25 (62.48)	1203.9 (90.82)	262.23 (59.30)	1113.00	164.21
Albumin (Milk and Egg)	Quantity	235.66 (1.71)	1381.00 (1.85)	1829.8 (10.54)	485.99	676.44
	Value	5.48 (3.45)	51.53 (3.88)	78.33 (17.71)	840.33	1329.4
Casein	Quantity	136.17 (0.99)	132.99 (0.17)	788.26 (4.53)	-2.33	478.86
	Value	4.38 (2.75)	5.39 (0.40)	37.64 (8.51)	23.05	759.36
Poultry products	Quantity	265.26 (1.92)	661.73 (0.89)	699.24 (4.02)	149.46	163.06
	Value	16.13 (10.15)	19.72 (1.48)	22.5 (5.08)	22.25	39.49
Other meat	Quantity	331.41 (2.40)	540.06 (0.72)	443.71 (2.57)	62.95	-85.69
	Value	6.67 (4.19)	12.36 (0.93)	15.06 (3.40)	85.30	-34.03
Sheep and Goat meat	Quantity	19.45 (0.14)	4.63 (0.0006)	47.43 (0.27)	-76.22	143.75
	Value	0.43 (0.27)	0.21 (0.01)	4.4 (1.00)	-51.16	923.26
Natural honey	Quantity	2799.67 (20.32)	107.05 (0.14)	79.26 (0.45)	-61.76	-71.68
	Value	18.67 (11.75)	10.09 (0.76)	14.95 (3.40)	-45.95	-19.92
Processed meat	Quantity	967.75 (7.02)	962.82 (1.29)	71.26 (0.41)	-0.50	-92.64
	Value	7.83 (4.92)	9.86 (0.74)	2.71 (0.61)	25.92	-65.39
Total	Quantity	13774.2 (100.00)	74460.18 (100.00)	17376.06 (100.00)	440.58	26.40
	Value	158.84 (100.00)	1325.49 (100.00)	442.22 (100.00)	734.78	178.00

Figures in the parentheses indicate percentage to total.

5.87 and 3.29 per cent, respectively. Natural honey recorded the positive growth at the rate of 12.29 per cent per annum. The growth rates of values of the exports of each livestock product showed an increased trend during the study period. The growth rates in dairy products export were found to be non-significant.

At overall period, the growth rate in total exports was 16.85 per cent per annum. The highest growth rates were found in natural honey followed by poultry products and dairy products, i.e. 36.12, 32.76 and 22.63 per cent, respectively. The significant growth rates were recorded in the sheep and goat meat, animal casings and processed

meat i.e. 3.88, 4.09 and 5.24 per cent, respectively.

#### Growth rates in imports of livestock products

The growth rates in imports of livestock products during the period 2008-09 to 2015-16 are presented in Table 4. The rate of growth in total imports of livestock products was 46.13, 20.51 and 8.14 per cent, during Period-I, II, and overall period, respectively.

During Period-I, growth in total imports of livestock products was found to be non-significant, while it decreased at the rate of 8.14 per cent during overall period. The growth in import of livestock products, viz; dairy products, albumin (milk and egg), casein, poultry

**Table 4: Growth rates in imports of livestock products in India**

Livestock products	Units	Period-I	Period-II	Overall Period
Dairy products	Quantity	50.11	16.31*	-23.63
	Value	93.28	10.99	-14.80
Albumin	Quantity	46.75	33.19	18.68**
	Value	82.80	13.41	32.94***
Casein	Quantity	8.57	105.81	44.00**
	Value	20.86	75.29	58.46***
Poultry products	Quantity	42.39	22.76	9.75*
	Value	-14.09	-1.92	5.52
Other meat	Quantity	28.10	19.10	2.67
	Value	36.12	4.20	17.51**
Natural honey	Quantity	-1.54	11.92	-21.20
	Value	14.47	42.05	2.27
Sheep/Goat meat	Quantity	-65.68	9.66	25.68
	Value	0.35	-24.11	-7.70
Processed meat	Quantity	17.20	10.49	-20.57**
	Value	-58.51	-27.31	43.85
Total	Quantity	46.13	20.51**	-8.14
	Value	82.68	12.84	-7.04

\*\*\*\*, \*\*\*, \*\*\*, \*' Indicate significance at 1, 5, 10 per cent level

**Table 5: Trade balance of livestock products of India**

(Quantity MT; Value ₹ Crore)

Year	Export		Import		Trade balance	
	Quantity	Value	Quantity	Value	Quantity	Value
2008-09	1656219.14	727246.94	13774.24	15856.27	+1642444.9	+711390.67
2009-10	1625690.74	748700.75	35332.48	39346.8	+1590358.26	+709353.95
2010-11	1334694.03	1049935.06	59449.09	90007.64	+1275244.94	-225309.88
2011-12	1677807.59	1519989.39	75453.72	31308.15	+1602353.87	+1388681.24
2012-13	1831917.17	2077822.70	11044.41	27986.29	+1803930.88	+2049836.41
2013-14	2112231.28	3228857.00	12678.12	34264.37	+2099553.16	+3194592.63
2014-15	2163060.54	3312830.32	16955.43	54277.79	+2146105.11	+1166275.21

('+' indicates trade surplus and '-' indicates trade deficit, Source- [www.apeda.org](http://www.apeda.org))

products, other meat, natural honey, sheep and goat meat, and processed meat during Period I was found to be non-significant, of this natural honey and sheep and goat meat had recorded the negative growth at the rate of 1.54 and 65.68 per cent respectively.

During Period- II, the significant growth in dairy products at the rate of 16.31 per cent and total imports at the rate of 20.51 per cent.

At overall period, the rate of growths in imports of albumin, casein and poultry products were 18.68, 44.00, and 9.75 per cent, respectively, whereas, the dairy products, natural honey and processed meat recorded negative growth rates with magnitudes as 23.63, 21.20 and 20.57 per cent, respectively.

#### Trade balance of livestock products of India

The trade balance of the livestock products occurred during the period of 2008-09 to 2014-15 has been depicted in Table 5.

The trade balance of the country was having a positive sign in each year, which showed that, the trade surplus condition in the country regarding imports and exports of livestock products. On the basis of these facts and figures, it could be concluded that our exports were more than that of the imports in the respective years. In case of value, excepting the year 2010-11, in which the values of livestock products decreased and the trade deficit condition arrived.

#### CONCLUSIONS

Livestock makes multi-faceted contribution to socio-economic development of rural areas. Due to this inelastic absorptive capacity for labour in the other economic sectors, livestock sector has the scope for generating more employment opportunities, especially for the marginal and small farmers and also landless labourers who own around 70 percent of the country's livestock. The analysis of exports and imports of the livestock products thus,

throws light on the national income which is ultimately owned by these farmers. The exercise thus, carried out can be concluded as below-

(I) India export the highest quantity of buffalo meat (69.50 per cent), (ii) significant growth rates were recorded in the sheep and goat meat (3.88 per cent) , animal casings(5.24 per cent ) and processed meat (4.09 per cent), (iii) in the case of imports, the dairy product ranks 1<sup>st</sup> in total imports of the country,(iv) natural honey recorded the highest growth(36.12 per cent per annum) in the export ,(v) the trade balance of the country showed the trade surplus situation in case of imports and exports of livestock products over the period of six years.

The exports and imports of livestock products analysis showed that the Indian exports are on positive move which can be considered in favour of the livestock sector which is comprises of mainly the rural small and marginal farmers. If the benefits of exports are properly streamlined, the incomes of these farmers will definitely

get increased to a considerably high level approaching to getting doubled in near future.

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## Diversification of Existing Farming Systems in Pune district of Maharashtra

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### ABSTRACT

A field experiment was conducted on farmer's field at plain zone area of Pune district during the year of 2013-14. The study was carried out with before and after approach for the economics of diversification of existing farming systems. Before diversification, the results of crop component, animal component, product diversification and capacity building were ₹360670, ₹42,640, ₹47,860, and ₹451170. After diversification these were increased ₹586624 (62.65%), ₹71601 (67.92 %), ₹59510 (24.34%) and ₹717735 (59.08%). These results were because of providing improved varieties and inputs, arranging visit and training to farmers on field crop production, providing technical knowledge of improved package of practices, supply for semen and artificial insemination and mineral mixture and goat kids of improved breed, providing technical knowledge regarding animal health and providing equipments like grading sieve /ghee making equipments, etc. The study results revealed that the interventions at each aspect of crop, animal and product diversification were increases in employment, income and improved the standard of living of selected farmers. The sustainable diversified farming systems are seen highly profitable and the appropriate diversification of components increases the production per unit area, and reduced the costs of production.

### Keywords

Cropping pattern and bench mark survey, diversification, existing farming systems, sustainability

### JEL Codes

Q 10, Q 16, Q 19, Q 81

### INTRODUCTION

Diversification is the outcome of the interactive effect of resource related factors viz; irrigation, rainfall, soil fertility, technology related factors viz; seed, fertilizers, marketing, storage, processing and household related factors viz; food and their price, etc. With the advent of modern technology, there is continuous surge for diversified agriculture in terms of crops, animals and product diversification with economic consideration. Crop diversification is needed to give a wider choice in the production of a variety of crops in a given area so as to expand production related activities on various crops and also to lesson risks. Crop diversification is generally viewed as a shift from traditional grown less remunerative crops to more remunerative crops. The crop diversification also takes place due to governmental policies and thrust on some crops over a period time. Market infrastructure development and certain other price related supports also induce diversification. High profitability and stability in production also induce diversification (Behera *et al.*, 2007).

The experiments have been conducted on farmer's field in six centers in Pune district. Pune district was selected purposively for the present study and study has been conducted during the year 2013-14 with the specific objectives as to estimate the profitability in crop, animal and product diversification of selected households, to improve the livelihood and nutritional security through diversification, to estimate the impact of capacity building through diversification and to study the constraints in diversification.

### MATERIALS AND METHODS

The data of 24 field experimental trials under 'On Farm Research Centre' at Haveli and Maval tahsils of Pune district were collected by the cost accounting method with the help of designed schedule provided by the Directorate, ICAR-Indian Institute Farming System Research, Modipuram, Meerut, Uttar Pradesh.

In each tehsil, three villages were selected and from each village four farmers were selected. Thus, total 24 farmers were selected for the study. The bench mark surveys were carried out for the year of 2011-12, and the

**Table 1: Treatments (Modules) conducted for diversification in Kharif and Rabi season (2013-14)**

Treatments	Interventions on Farmer's field
M <sub>0</sub> . Bench marks	Comprehensive survey along with GPS location.
M <sub>1</sub> . Crop diversification	Change the cropping pattern and provided improved varieties with chemical fertilizers.
M <sub>2</sub> . Livestock diversification	Supplies of Phule Triveni semen for A.I, mineral mixture, goat kids and poultry chicks of improved breed.
M <sub>3</sub> . Product diversification	Provided grading sieves /ghee making equipments.
M <sub>4</sub> . Capacity building	Arranged training and provided Sugi magazine /Krishi dairy to selected farmers.

diversification experimental field trials were conducted in Kharif and Rabi season during the year 2013-14 (Table 1).

### RESULTS AND DISCUSSIONS

#### Existing and diversified cropping pattern of sample farmers

Crop pattern changes increasing tendency towards crop specialization and commercialization of agriculture. The existing and diversified cropping pattern of sample farmers are depicted in Table 2. The cropping pattern is dependent on several factors such as soil type, climate,

resource availability with the farmers, decision making ability of the farmers under situation of changing prices and relative price of output of different crops. Low yield and long duration of existing varieties replaced by improved varieties.

#### Effect of diversification on the productivity and returns of different crops

The per hectare production and net returns of all selected crops for the year of 2011-12 benchmark survey are given in Table 3, and also for the year 2013-14. After

**Table 2: Existing and diversified cropping pattern of sample farmers**

Existing cropping pattern (2011-12)				Diversified cropping pattern (2013-14)			
Kharif		Rabi		Kharif		Rabi	
Name of crop	Variety	Name of crop	Variety	Name of crop	Variety	Name of crop	Variety
Groundnut	SB-11 /Jalgaon/	Onion	Puna Fursungi	Soybean	JS-335	Onion	N-2-4-1
Paddy	Darna	Chickpea	Vijay/local	Soybean	JS-335	Chickpea	Digvijay
Soybean	MACS-123	Wheat	HD-2189	Soybean	JS-335	Wheat	NIAW-301
Paddy	Darna	-	-	Paddy	Phule	-	-
Soybean	Local	-	-	Soybean	JS-335	-	-
Grass	Local	-	-	Hybrid Napier	Phule Jayawant	-	-
Maize (fodder)	Panchganga	-	-	Maize (fodder)	African tall	-	-

**Table 3: Effect of diversification on the productivity and returns of crops**

Name of crop	Existing		Diversification		Per cent increase	
	Average productivity	Gross returns	Average productivity	Gross returns	Average productivity	Gross returns
Paddy	23.00	38800	29.51	72836	28.30	87.72
Soybean	18.00	37500	21.66	56024	20.33	49.40
Groundnut	17.39	28600	18.19	72759	4.60	154.40
Maize (fodder)	263.20	39020	380	43000	44.38	10.20
Wheat	21.00	43200	34.64	66181	64.95	53.20
Onion	210.00	114000	240.75	184815	14.64	62.12
Chickpea	22.40	55400	29.81	77509.43	33.08	39.91
Grass	41.50	4150	-	-	-	-
Hybrid Napier	-	-	24.00	13500	-	-
<b>Total</b>	-	<b>360670</b>	-	<b>586624.4</b>	-	<b>62.65</b>

diversification, per hectare production and net returns of all crops were seen increased due to replacement of local and low yielding varieties with hybrid and improved varieties. The per hectare net returns from the crop component before the diversification were ₹360670 and after the provision of technical knowledge about package of practices, it was increased by 62.65 per cent (₹586624.40). Similar results were reported by Bhende *et al.* (1994) and Gill *et al.* (2005).

**Profitability from existing and diversified animal component**

Before diversification (Table 4), the milk production of cow and buffalo were 1400 litres and 720 litres for the year 2011-12. After diversification, the milk production of cows and buffaloes increased by 1562 litres and 851 litres for the year 2013-14. The net returns from the animal component before diversification was ₹25284 and after diversification, it increased by ₹43060 (70.31 per cent). Similar results were reported Hadole & Tawade (2003). It is definitely attributed to making available the

improved breed semen for artificial insemination of Phule Triveni, the improved goat kid of Sangamneri / Osmanabadi breed, mineral mixtures and provided technical knowledge of animal health, etc.

**Profitability from product diversification**

Technology related factors not only seed, fertilizers, marketing, storage but also processing were covered. There was not any equipment for grading the food grains and for making the ghee from milk. Farmers get low price for food grain and also there was lack of technical knowledge about value addition. To adopt the product diversification, farmers are provided with sieve for grading food grains and also provided equipment for ghee making. The profitability from product diversification is indicated in Table 5.

Before diversification the processing total value of the gross returns from soybean and milk was ₹23598 and ₹24262. After diversification the processing total value of the gross returns from soybean and milk was increased by ₹28118 and ₹31392. The gross returns from soybean,

**Table 4: Profitability from existing and diversified animal component**

Name of animal	Milk (litre/year/animal)	Gross returns diversified	Cost of rearing	₹/animal/year	
				Net returns	B:C ratio
<b>Benchmark status (Existing- 2011-12)</b>					
Cow	1400	19600	10184	9416	1.92
Buffaloes	720	23040	7172	15868	3.21
Goat	-	-	-	-	-
Total	2120	42640	17356	25284	2.46
<b>Diversified (2013-14)</b>					
Cow	1562	29687	11363	18324	2.61
Buffaloes	851	28914	8478	20436	3.41
Goat	210	13000	8700	4300	1.49
Total	2623	71601	28541	43060	2.51
<b>Per cent increase over existing</b>					
Cow	11.57	51.46	11.58	94.60	-
Buffaloes	18.19	25.49	18.21	28.79	-
Goat	-	-	-	-	-
Total	23.73	67.92	64.44	70.31	-

**Table 5: Profitability from product diversification**

Name of product	Existing			Diversification			Gross returns increased due to product diversification (Per cent)
	Quantity	Price (₹/kg)	Total Value (₹)	Total product obtained after processing (kg)	Price (₹/kg/l)	Total Value (₹)	
Soybean	874 kg	27.00	23598	827	34	28118	19.15
Milk	1347 litre	18.00	24262	a. Ghee : 28.94 b. ButterMilk : 1040 litre	366 20	10592 20800	
<b>Total</b>			<b>47860</b>	c. Milk by product		<b>31392</b>	<b>29.38</b>
						<b>59510</b>	<b>24.34</b>

**Table 7: Capacity building on different component**

Capacity building on different component	Title of training	Pre evaluation score (out of 100) before training	Post evaluation Score (out of 100) after training	Gross income (₹) before training	Gross income (₹) (6 months after training)	Gross income increased due to training (Per cent)
Crop	<ul style="list-style-type: none"> <li>Field crop production,</li> <li>Visits to various agriculture exhibitions, agriculture college farm, mushroom production plant, bio-fertilizer production plant and conducting field days</li> </ul>	45	73	360670	586624	62.65
Animal	Technical knowledge of animal housing /nutrition/ breed/ health	49	75	42640	71601	67.92
Product diversification	Grading sieve /ghee making	43	68	47860	59510	24.34
<b>Total</b>		<b>137</b>	<b>216</b>	<b>451170</b>	<b>717735</b>	<b>59.08</b>

**Table 6: Livelihood and nutritional security through diversification approach**

Name of items	Quantity used/year (kg)	Price (₹/kg)	Total expenditure (₹)	Per cent
Edible	56	85	4760	16.1
Wheat	206	20	4120	13.9
Jowar	100	30	3000	10.1
Paddy	233	34	7922	26.8
Green	43	85	3655	12.3
Pigeon	25	73	1825	6.18
Potato	42	27	1134	3.84
Chicken/ Meat	7	292	2044	6.92
Egg	60	5	300	1.02
Ghee	3	253	759	2.57
<b>Total</b>			<b>29519</b>	<b>100.</b>

milk and milk by product was increased by 19.15 and 29.38 per cent. The total gross returns increased after diversification was 24.34 per cent due to product diversification. Similar results were reported by Gangwar and Ravisankar (2013) and Sachin Kumar *et al.* (2012).

#### **Livelihood and nutritional security through diversification approach**

It is revealed from the Table 6, the expenditure on consumption of paddy was more (226.84 per cent) followed by edible oil, wheat, green gram, jowar, pigeon pea, chicken/meat, potato, ghee and egg were daily consumed by sample households.

#### **Capacity building on different component**

From the Table 7, before diversification, the gross

income from different components was ₹451170 and after diversification it increased by ₹717735. It can be attributed to providing technical knowledge and improved package of practices, arranging visit and training to farmers, supply of semen artificial insemination and mineral mixture and goat kids of improved breed, providing technical knowledge of animal health and providing grading sieve /ghee making equipment, etc. These results are in consonance with findings of Mahaptra (1994) and Walia *et al.* (2016).

#### **Constraints in crop, animal and product diversification**

The major problems and constraints in crop diversification identified were, Unavailability of improved variety seeds, imbalanced fertilizer use by the farmers, unavailability of mineral mixtures, unavailability of improved breed and lack of technical knowledge about feeding/ animal nutritional and housing, etc.

#### **CONCLUSIONS**

After diversification the net returns from crop component, animal component and product processing were increased by 13.34, 69.38 and 72.38 per cent, respectively, and total gross income after capacity building on different components increased by 25.85 per cent. Thus, diversification of existing farming systems was profitable and increase the output and also there cost was reduction.

The diversification farming systems provides sustainable productivity and profitability through resource recycling and replacing in all the micro farming and it would provide maximum net returns per unit land area. The diversification component provides

employment for the farm family throughout the year. It can be recommended that diversification farming systems is suitable for plain zone area of Pune district.

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## **Economic Impact of Non Timber Forest Products on Tribes of Chhattisgarh**

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### **ABSTRACT**

The present paper attempts to examine the collection, consumption, selling, income and employment and also disposal pattern of major NTFPs by forest dwelling tribes in Chhattisgarh. The sample of 240 respondents was selected through multistage sampling technique from state. The study revealed that on an average 1110.22 Kg. of NTFPs were collected and out of those only 5.02 per cent was consumed and rest was sold in the market. While average largest collected NTFP was Sal seed 29.31 per cent of collection followed by Mahua flower and Tamarind with 28.89 per cent and 13.07 per cent respectively. The lowest share of collection was by Honey with only 0.75 per cent out of total collection in Chhattisgarh. The disposable pattern of NTFPs in state was showed that 53.44 per cent of the sold quantities of NTFPs are traded to minor forest produce society (MFPS) followed by village merchant and directly to consumer with 35.15 and 11.41 per cent respectively for total quantity of 1054.43 Kg. for Chhattisgarh.

### **Keywords**

Economics, employment and disposal pattern, income, NTFPs

### **JEL Codes**

Q13, Q23, Q50, Q56, R10

### **INTRODUCTION**

Non-Timber Forest Products play a vital role in the livelihood of people in and around the forests. NTFPs comprise medicinal plants, dyes, mushrooms, fruits, resins, bark, roots and tubers, leaves, flowers, seeds, honey and so on (Anonymous, 1995). NTFPs (also called as "minor forest products" in national income accounting system) are sources of food and livelihood security for communities living in and around forests. They are also known as Non-wood, minor, secondary, special or specialty forest products (Shiva, 1993). At global level, more than two billion people are dwelling in forest, depending on NTFPs for subsistence, income and livelihood security (Vantomme, 2003). NTFPs are considered to be important for sustaining rural livelihoods, reducing rural poverty, biodiversity conservation, and facilitating rural economic growth (Global NTFP partnership, 2005). An estimated 80 per cent of the population of the developing world uses NWFP (Non-Wood Forest Products) to meet some of their health and nutritional needs (FAO, 2008). It is an important source of income for the poor in many developing countries. In addition, several opportunities

for improved rural development are linked to NTFP.

In India over 50 million people are dependent on NTFPs for their subsistence and cash income. This provides 50 per cent of household income for 20 to 30 per cent of rural population particularly for tribal. Potentially around 3000 species of forest products are found to be useful, but only 126 have developed marketability (Maithani, 1994). Around 50 per cent of forest revenues and 70 per cent of forest based export income of the country comes from NTFPs. Thus it can be depicted that NTFPs form one of the mainstays of income and sustenance for many tribal communities (Gauraha, 1992, Chopra, 1993; Mallik, 2000). The collection of NTFPs by tribals was primarily for meeting their subsistence needs. Over time, these NTFPs acquired commercial value resulting from huge trade transactions and income levels due to rising demand. Trade in NTFPs can act as an incentive for forest conservation by providing a source of income from resources that might otherwise appear to have little financial value.

Chhattisgarh is the third largest state of India in terms of forest cover which is 5.6 million hectares which is 46.39 per cent of state and 8.06 per cent of the country. Madhya

Pradesh and Arunachal Pradesh being at first and second in terms of forest cover (Forest Census, 2011). Out of the total population of Chhattisgarh, tribals constitute about 32.5 per cent mostly live in dense forested areas in Sarguja and Bastar (Census, 2011) and are known for their unique lifestyle, rituals, traditions and superstitions. The importance of Non Timber Forest Products (NTFPs) contributing to rural livelihoods and alleviating rural poverty is well known in Chhattisgarh. Non-timber forest products are emerging as the major source of income for the rural poor. Earlier NTFPs were only collected but now a day's NTFPs like Lac, Kalmegh are cultivated as well in Chhattisgarh. The Chhattisgarh state is one of the biodiversity-rich forest regions of India, and little information is available on the NTFPs of this region. Therefore, this study was undertaken in Chhattisgarh with the objective of finding out the collection, consumption, selling, income and employment and also disposal pattern of major NTFPs by forest dwelling tribes.

## METHODOLOGY

### Sampling design

The selection of region, district, blocks, village, and NTFP's collectors are presented under the following sub sections.

### Selection of Study Area

The recorded forest area in the state is 56.772 km<sup>2</sup> with is 44.21 percent of total geographical area. The Study will be conducted in all 3 agro-climatic zones of Chhattisgarh. Chhattisgarh is having 27 districts, for the study one district from each agro climatic zone viz. Dantewada, Sarguja, and Rajnandgaon are selected on the basis of forest cover and presence of tribal communities. The two blocks will be selected randomly from each district. Thereafter two villages from each block will be selected randomly and presented in Table 1.

**Table 1: Sampled districts, blocks and villages for study**

Districts	Blocks	Villages
Dantewada	Dantewada	Teknar, Balood
	Gedam	Ghotpal, Gedam (Sonarpara)
Rajnandgaon	Choki	Jhiratola, Kesala
	Mohala	Urawahi, Hatharel
Ambikapur	Sitapur	Tangar Sur, Devgarh
	Udaipur	Sanibarara, Sukharibhandar

### Selection of NTFP Collectors

Twenty respondents (tribal NTFPs collectors) will be selected randomly from each of the selected villages. Thus, 240 respondents will be selected from the selected area.

### Method of Enquiry and Data Collection

Primary data from the selected NTFP collectors will be collected through well prepared and tested schedule. The data includes cost of different operations and manpower and time involved in collection, marketing and primary processing of different NTFPs at farm level and also financial help provided by the state government and

forest department. The data were collected in the month of December 2015 to January 2016 from selected tribal forest dwellers by personal interview method. The analysis of collected data was carried out by using mathematical and statistical tools like summation, percentages, averages, means etc.

## RESULTS AND DISCUSSION

The collection of NTFPs by tribals in study area was primarily for meeting their subsistence needs. Over time, these NTFPs acquired commercial value resulting from huge trade transactions and income levels due to rising demand. Trade in NTFPs can act as an incentive for forest conservation by providing a source of income from resources that might otherwise appear to have little financial value. But these NTFPs support livelihood of these tribal forest dwellers living in remote and dense forest areas. Hence looking these entire situation this paper attempts to describe the collection, consumption, selling, income and employment and also disposal pattern of major NTFPs by forest dwelling tribes under the following heads.

### Collection of Non-Timber Forest Products

It can be seen from Table 2 that on an average 1110.22Kg NTFPs was collected by the selected tribal households. In which Sal Seed is the most prominently collected NTFPs with 325.36 kg (29.31 per cent) per household followed by Mahua Flower at 320.75 kg. (28.89 per cent), Tamarind at 145.15 kg (13.07 per cent), Mahua seed 94.55 kg (8.52 per cent), Tendu leaves at 77.96 kg (7.02 per cent), Harra at 51.89 kg (4.67 per cent) and Baheda at 39.73 kg (3.58 per cent). The lowest share in collection was contributed by Honey at 8.83 (0.75 per cent) followed by Chironji seed at 10.86 kg (0.98 per cent) and Ber at 35.69 (3.21 per cent) to the total quantity of NTFPs collected per household. Narendran *et al.* (2001) studied the NTFP extraction, utilization and valuation in five forest types (Dry deciduous, Moist deciduous, Dry thorn, Evergreen and Montane) of Nilgiri Biosphere Reserve (NBR) in Tamilnadu. Study reported quantum of NTFP extractions were relatively higher from the tropical evergreen and tropical moist deciduous compared to other forest types. Similar kind of results was also reported by Krishnamoorthy *et al.* (2003); Gubbi & MacMillan (2008); Kumar (2014).

### Consumption of Non-Timber Forest Products

It has been presented in Table 2 that overall 55.79 Kg. NTFPs were consumed by tribal forest dwellers in Chhattisgarh. On an average consumption of Honey was found highest as compared to other NTFPs being at 23.11 per cent followed by Ber at 20.05 per cent, Chironji seed at 18.39 per cent and Mahua flower at 9.72 per cent whereas, consumption of other NTFPs was found very low. Some of the NTFPs were non-edible viz. Sal Seed, Tendu Leaves, Harra and Baheda. Bhattacharya & Patra (2004) examined consumption pattern of 38 Non-Wood Forest Products. This study indicated that villagers consumed sufficient quantities of the total NWFP, 76 per

**Table 2: Average collection, consumption, selling, income, and employment from NTFPs in Chhattisgarh**

Name of NTFPs	Quantity collected (kg)	Quantity consumed (kg)	Quantity sold (kg)	Selling price of NTFPs (₹/ kg)	Income generated through NTFPs (₹)	Employment days involved in collection of NTFPs	Active hours of work in a day
Mahua Flower	320.75 (28.89)	31.19 (9.72)	289.56 (90.28)	17.34	4973.95 (19.07)	22.00 (19.30)	5.98
Mahua Seed (Stone)	94.55 (8.52)	3.19 (3.38)	91.35 (96.62)	21.19	1937.26 (7.43)	12.00 (10.53)	4.47
Tamarind	145.15 (13.07)	10.33 (7.12)	134.82 (92.88)	20.71	2762.28 (10.59)	5.00 (4.39)	5.45
Tendu Leaves	77.96 (7.02)	0.00 (0.00)	77.96 (100)	120.00	9354.80 (35.87)	7.00 (6.14)	6.75
Chironji seed	10.86 (0.98)	2.00 (18.39)	8.86 (81.61)	102.10	890.35 (3.41)	9.00 (7.89)	6.15
Sal seed	325.36 (29.31)	0.00 (0.00)	325.36 (100)	10.00	3253.65 (12.48)	20.00 (17.54)	6.70
Harra	51.89 (4.67)	0.00 (0.00)	51.89 (100)	9.35	487.60 (1.87)	12.00 (10.53)	6.50
Baheda	39.73 (3.58)	0.00 (0.00)	39.73 (100)	12.64	507.16 (1.94)	10.00 (8.77)	5.64
Ber	35.60 (3.21)	7.14 (20.05)	28.46 (79.95)	9.47	269.07 (1.03)	10.00 (8.77)	4.85
Honey	8.38 (0.75)	1.94 (23.11)	6.44 (76.89)	256.35	1641.82 (6.30)	7.00 (6.14)	4.31
<b>Total</b>	<b>1110.22</b> <b>(100)</b>	<b>55.79</b> <b>(5.02)</b>	<b>1054.43</b> <b>(94.98)</b>		<b>26077.93</b> <b>(100)</b>	<b>114.00</b> <b>(100)</b>	

Figures in parentheses are.....

cent consumed by them as food whereas 24 per cent are sold for income generation. Rout *et al.* (2010); Johnson *et al.* (2013) were also coated similar kind of results in their studies.

#### Selling of Non-Timber Forest Products

Further the Table 2 also shows that on an average out of the total collected NTFPs, 94.98 per cent was sold in the market. Amongst the NTFPs in the state selling of NTFPs like Tenduleaves, Sal seed, Harra and Baheda were sold cent-per-cent at the rate of ₹120.00, ₹ 10.00, ₹ 9.35 and ₹12.64 respectively followed by Mahua seed (96.62 per cent), Tamarind (92.88 per cent), Mahua flower (90.28), Chironji seed (81.61 per cent), Ber (79.95 per cent) and Honey (76.89 per cent) at rate of ₹21.19, ₹20.71, ₹17.34, ₹102.10, ₹9.47, and ₹256.35 respectively. Paloti and Hiremath (2005) assessed the role of NTFPs in economic empowerment of rural women. The availability and collection of edible Gum was in lesser quantity (25 kg) which was used in special sweet dishes and sold with high market price that could able to fetch higher income of ₹1960 per season. Among fruits Amla fetched highest income of ₹1480 per season. Muthyalu (2008); Maske *et al.* (2011) also reported the Sale of NTFPs in market for better price.

#### Income generated through selling of NTFPs

The perusal of Table 2 also showed, on an average ₹26077.93 per household were generated through the

selling of NTFPs. Amongst the NTFPs Tendu leaves contributes 35.87 per cent (₹9354.80) followed by Mahua flower (₹4973.95), Sal seed (₹3253.65), Tamarind (₹2762.28), Mahua seed (₹1937.26), Honey (₹1641.82), Chironji seed (₹890.35), Baheda (₹507.16) and Harra (₹487.60) at 19.07, 12.48, 10.59, 7.43, 6.30, 3.41, 1.94, and 1.87 per cent respectively. The lowest income was generated through Ber 269.07 (1.03 per cent).

Krishnamoorthy *et al.* (2003) analyzed collection and marketing of NTFPs in Tamilnadu. The study reported that in Pollachi range also the main occupation of tribals was NTFPs collection with agriculture as the secondary occupation. They found average annual income per household from NTFP collection was highest in Sathyamangalam range, which was ₹17088.20. Paloti and Hiremath (2005), Muthyalu (2008), Maske *et al.* (2011) and Kumar (2014) were also reported same kind of results in their studies.

#### Employment Generated through Collection of NTFPs

Table 2 shows that the per household average number of collection days for NTFPs were 114 man days, out of those Mahua flower generated highest employment days (22 man days) followed by Sal seed, Mahua seed, Harra, Baheda, Ber, Chironji seed, Tendu leaves, Honey and Tamarind generated 20, 12, 12, 10, 10, 9, 7, 7 and 5 man days of active employment. Gubbi and MacMillan (2008) examined whether NTFPs collection can solve the livelihood problems and give good economic return to

**Table 3: Overall disposal pattern of NTFPs in Chhattisgarh**

Name of NTFPs	Quantity of NTFPs traded	Disposal pattern of NTFPs (%)		
		Consumers	Village merchant	Minor forest produce society
Mahua flower	289.56 (100)	68.88 (23.79)	220.79 (76.25)	0.00 (0.00)
Mahua seed (Stone)	91.35 (100)	20.92 (22.90)	37.13 (40.64)	33.30 (36.45)
Tamarind	134.82 (100)	18.91 (14.03)	50.15 (37.20)	65.75 (48.77)
Tendu leaves	77.96 (100)	0.00 (0.00)	0.00 (0.00)	77.96 (100)
Chironji seed	8.86 (100)	1.46 (16.44)	1.88 (21.19)	5.54 (62.58)
Sal seed	325.36 (100)	0.00 (0.00)	0.00 (0.00)	325.36 (100)
Harra	51.89 (100)	0.00 (0.00)	16.17 (31.17)	35.72 (68.84)
Baheda	39.73 (100)	0.00 (0.00)	23.66 (59.55)	16.07 (40.45)
Ber	28.46 (100)	8.61 (30.26)	19.85 (69.74)	0.00 (0.00)
Honey	6.44 (100)	2.63 (40.74)	0.00 (0.00)	3.82 (59.26)
<b>Total</b>	<b>1054.43</b> <b>(100)</b>	<b>121.41</b> <b>(11.41)</b>	<b>369.63</b> <b>(35.15)</b>	<b>563.53</b> <b>(53.44)</b>

Figures in parentheses indicates percentage to total

collectors in Periyar tiger reserve, India. They found in the study that Mean daily revenue of NTFPs collection was USD 3.15± SD 4.19 per day. For 61 per cent of respondents NTFPs are main source of livelihood and rest 39 per cent collected NTFPs to supplement their income. Most collectors (82 per cent) did not wish to continue harvesting NTFPs if alternative livelihoods from agriculture can be provided. Paloti and Hiremath (2005), Maske *et al.* (2011); Kumar (2014) also reported same kind of result regarding employment.

#### Active Hours of Work in Collection of NTFPs

Table 2 also shows that the per household average active number of hours for NTFPs collection was highest for Tendu leaves (6.75 hours per day) followed by Sal seed, Harra, Chironji seed, Mahua flower, Baheda, Tamarind, Ber, Mahua seed and Honey generated 6.70, 6.50, 6.15, 5.98, 5.64, 5.45, 4.85, 4.47, and 4.31 hours per day respectively. Paloti and Hiremath (2005) assessed the role of NTFPs in economic empowerment of rural women. The study showed that rural women spent maximum time as about 251.17 minutes per day in the collection of forest produce, followed by marketing (203.46 minutes per day) and processing (182.96 minutes per day). Similar kinds of finding were also observed in study of Gubbi & MacMillan (2008).

#### Disposable Pattern of NTFPs in Chhattisgarh

The disposable pattern of NTFPs in Chhattisgarh was

presented in Table 3 which shows that 53.44 per cent of the sold quantities of NTFPs were traded to Minor Forest Produce Society (MFPS) followed by village merchant and directly to consumer with 35.15 and 11.41 per cent respectively for total quantity of 1054.43 Kg. NTFPs. NTFPs like Sal seed and Tendu leaves were only traded to primary minor forest produce society. In the case of other edible NTFPs Harra, Chironji seed, Honey and Tamarind are traded largely to primary minor forest produce society with 68.84 per cent, 62.58 per cent, 59.26 per cent and 48.77 per cent respectively. Mahua flower, Mahua seed, Baheda and Ber are preferred to sell to the village level merchant (Kochia) with 76.25 per cent, 40.64 per cent, 59.55 per cent and 69.74 per cent respectively. Out of the total NTFPs traded 11.41 per cent directly reaches to the consumer without any mediator or commission agent

#### CONCLUSIONS

In conclusion, the present research and enquiry would be greater significant to the policy makers. Further, economists may develop new policies on the marketing of non-timber forest products (NTFPs) so that the profitability share (producers share in consumer rupee) should be increased. The study shows that farmers are not cultivating the NTFPs but making profit out of it by collecting them and selling into the market either directly to the consumers or through the mediators at different levels. The state Government also plays a key role in

enhancing their profit by procuring most of the NTFPs either through commission agents or through primary minor forest produce society at village level. Further research is, however, required to compare NTFP revenues within other protected areas to understand further the social, economic and legal factors affecting incomes from NTFPs. Results of such studies will further strengthen the case for or against NTFPs collection as a mechanism for alleviating poverty and supporting wildlife conservation.

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## **Importance of Livestock Sector in Doubling Farmers Income by 2022**

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### **ABSTRACT**

The present paper mainly focuses on the target of doubling the farmers' income by 2022. In this context emphasis is mainly given to the livestock sector especially dairy sector. It is an attempt to show the importance of livestock sector and their hidden potential which farmers' can utilize in their farming system in order to increase their income apart from agriculture. India has the largest livestock resources when compared to other countries. So it is a boon extremely for the small farmers who own a small piece of land. Therefore, there is a need is to identify its unrealized potential and utilize it in an efficient way.

### **Keywords**

Farmer, income, livestock

### **JEL Codes**

E01, E6, Q18, Q19

### **INTRODUCTION**

Agriculture plays a vital role in India's economy. Over 58 per cent of the rural households depends on agriculture as their principal means of livelihood. Agriculture, along with fisheries and forestry, is one of the largest contributors to the Gross Domestic Product (GDP). As per estimates by the Central Statistics Office (CSO), the share of agriculture and allied sectors (including agriculture, livestock, forestry and fishery) is 15.35 per cent of the Gross Value Added (GVA) during 2015-16 at 2011-12 prices. But agriculture sector is not free of constraints due to which the farm income gets reduced. For example, we know that majority of farm households have less than 2 acres of land. Large land holdings enable the farmer to implement modern agricultural techniques and boost productivity. Small land holdings restrict the farmer to use traditional methods of farming and limit productivity. As land holdings are small, more people invariably work on the farms in the rural areas and coupled with the obsolete technology, farm incomes come down. Thus, there is need to think beyond 'food security' of the country to focus on 'income security' of the farmer.

We may start by saying that nothing is impossible; dreaming big, that too for the long-neglected cause of farmers, is a sign of boldness. But realization of any bold

dreams requires four things: a clearly defined vision, a carefully crafted strategy for achieving it, sufficient financial resources to support the efforts and above all, a better management group to lead and persevere on the path until the goal is reached. But there are some challenges which are required to be met before achieving the target of doubling the farmers' income by 2022. These are:-

First, there are no current estimates of farmers' incomes. The latest available survey from the National Sample Survey Office (NSSO) is for 2012-13. There is an obvious need to launch a survey of farmers' incomes for the current year (2016-17), which would provide a base against which the 2022 income levels can be compared. That would allow for assessing the actual performance vis-à-vis the dream outlined by Honorable Prime Minister Sh. Narendra Modi.

Second, it is not clear whether the target for doubling incomes is in real or nominal terms. This is critical, as the vision loses its novelty and valour if the target is in nominal terms. Nominal incomes, in any case, double in 6-7 years. The government's grit is tested only when the dream is of doubling real incomes. Linked to this is the use of the right price deflator for estimating real growth in incomes. Here, it has to be the consumer price index for

agricultural labourers (CPI-AL), not the wholesale price index or the GDP deflator. The reason for it is that we are looking not at the farm sector's income, but the incomes of farmers emanating from diverse sources.

### Comparison of Farmers Income

The NSSO's situation assessment surveys (SAS) for 2012-13 and 2002-03 give a fair idea of the movement in farmers' incomes. The accompanying charts give the compounded annual growth rates (CAGR) in nominal as well as real incomes (deflated by state specific CPI-AL) of farmer households during 2002-03 to 2012-13, apart from the changing composition of these incomes over the same period.

- In 2012-13, an average Indian farmer's monthly income was ₹6426. Punjab farmers had the highest income at ₹18059, followed by those in Haryana (₹14434), Jammu & Kashmir (₹12683) and Kerala (₹11888). Bihar farmers earned the least, with their monthly incomes averaging ₹3558.
- The CAGR of farmers' nominal incomes between 2002-03 and 2012-13 was 11.8 per cent at an all-India level. Within this, Haryana registered the highest growth (17.5 per cent) and West Bengal the lowest (6.7 per cent).
- In real income terms, Odisha emerged as the top performer with a CAGR of 8.3 per cent, closely followed by Haryana (8 per cent), Rajasthan 7.9 (per cent) and Madhya Pradesh (7.3 per cent), as against a national average of 3.5 per cent. The worst performers were

Bihar and West Bengal, with negative real growth rates in their farmers' incomes.

### Sources of Income

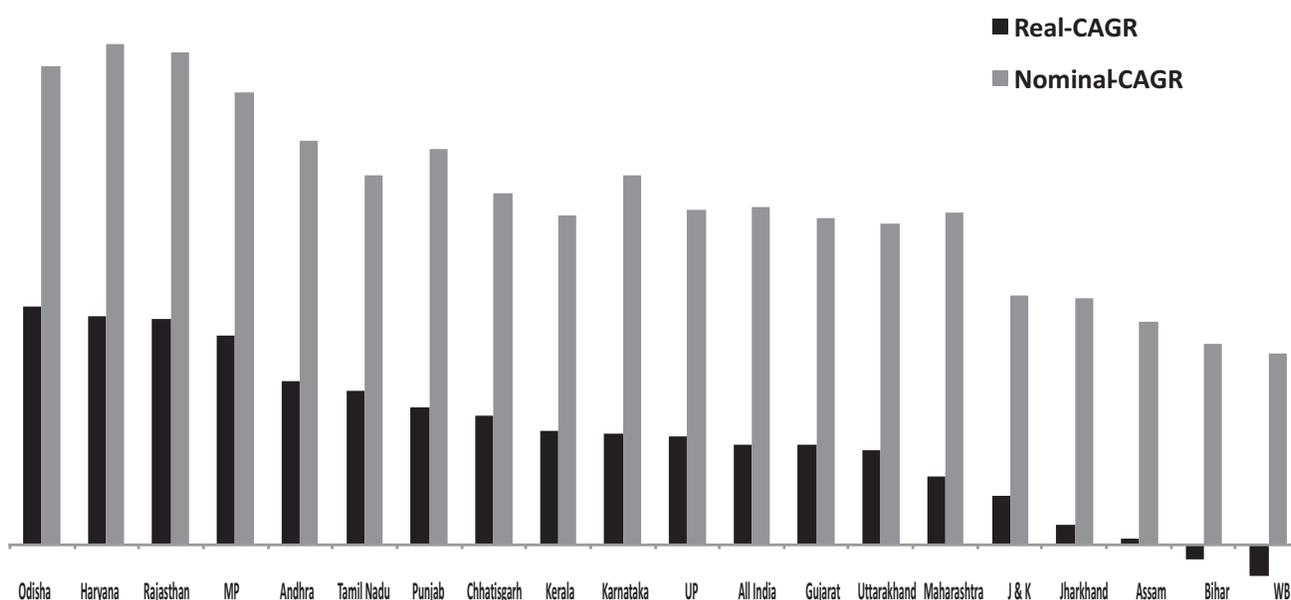
Coming to sources of farmers' income, the share from cultivation rose from 45.8 per cent in 2002-03 to 47.9 per cent in 2012-13. But the share of income from farming of animals is the one that grew the most, from 4.3 per cent to 11.9 per cent, while the contribution from both non-farm business and wages & salaries declined over this period. Thus, the highest growth is registered in receipts from livestock farming and it has increased its share in total income of a farm household from 4 per cent to 13 per cent. And this is true, especially in states that showed overall higher real income growth rates.

Across landholding classes, the lowest land class (with less than 0.01 ha land) earned ₹54147 in the period while the largest land class (with greater than 10 ha land) earned ₹452299 in the period. The lowest land class earned one per cent of their incomes in crop cultivation while the largest earned 86 per cent of their total incomes from crop cultivation. Livestock contributed to 36 per cent of total income for lowest land class and seven per cent to the highest land class. Thus there is need to put special attention towards the growth of livestock sector. Even, "Unleashing the full potential of livestock sector is one of the measures of doubling the farmers' income by 2022."

### Importance of Livestock Sector

Livestock sector plays a crucial role in rural economy and livelihood. The agricultural system of our country is predominantly a mixed crop-livestock farming system in which crop production is combined with the rearing of

Farmers' income growth rate between 2002-03 and 2012-13



Source: Anonymous (2012-13)

livestock. As per report of the working group on animal husbandry and dairying- 11th five year plan: 2007-12, about 20.5 million people depend upon livestock for their livelihood. Livestock contributed 16 per cent to the income of small farm households as against an average of 14 per cent for all rural households. Livestock provides livelihood to two-third of rural community. It also provides employment to about 8.8 per cent of the population in India. Livestock sector contributes 4.11 per cent GDP and 25.6 per cent of total Agriculture GDP.

Table 1 depicts the growing importance of livestock sector as its percentage share in GDP goes on increasing in comparison to agriculture sector.

Also, it is interesting to note that today economic / monetary contribution of the livestock is more than the food grain crops. It is so because traditionally, the crops were drivers of farm growth and food grain crops were major part of it; and this was the reason that the government policy and programmes were focused on crops. But slowly and gradually, the increased contribution of livestock is hinting towards a structural shift in the agricultural sector in the country. The policy makers are now recognizing livestock as the engine of agriculture growth. Both livestock and fisheries components have been growing faster than the crops component for a decade. Livestock now controls a quarter of the agriculture gross domestic product (GDP). There are several reasons of this phenomenon, enumerated as below:

- Livestock are the best insurance against the vagaries of nature like drought, famine and other natural calamities. They supplement family income and generate gainful self-employment, particularly for landless labourers, small and marginal farmers and women.
- Livestock Sector not only provides essential proteins and nutritious human diet through milk, egg, meat etc., but also plays an important role in utilization of non-edible agricultural by-products. Livestock also provides raw material by-products such as hides, skin, blood, bone, fat etc.
- Animals are natural capital, which can be easily reproduced to act as a living bank with

offspring as interest, and an insurance against income shocks of crop failure and natural calamities.

### Livestock Resources

When we talk about the population of livestock then as per 19th Livestock census, 2012 (Anonymous, 2014) India's livestock sector is one of the largest in the world with a holding of 11.6 per cent of world's livestock population which consists of buffaloes (57.83 per cent), cattle (15.06 per cent), sheep (7.14 per cent), goats (17.93 per cent), camel (2.18 per cent), equine (1.3 per cent), pigs (1.2 per cent), chickens (4.72 per cent) and ducks (1.94 per cent). Livestock population in India has increased substantially in Gujarat (15.36per cent), Uttar Pradesh (14.01per cent), Assam (10.77 per cent), Punjab (9.57 per cent), Bihar (8.56 per cent), Sikkim (7.96 per cent), Meghalaya (7.41 per cent), and Chhattisgarh (4.34 per cent). Looking into such a huge per cent that India contributes to the livestock sector we must say that it holds some top rank in livestock sector. India stands first position in buffalo population and second position in overall cattle population. The Table 2 gives the rank of India in the world in terms of livestock population.

From the Table 2 it is clear that India is not lacking in livestock population, only thing required is to utilize them in a proper way so that they serve as a source of income.

**Table 2: Position of India in world population**

Livestock population	Number (Millions)	India's position in the world
Cattle	190.9	Second
Buffalo	108.7	First
Sheep	65.0	Third
Goat	135.2	Second
Camel	-	Tenth
Duck	-	Fifth
Chicken	-	Fifth

Source: Anonymous, 2014

### Contribution of Livestock

The livestock provides food and non-food items to the people.

**Food:** The livestock provides food items such as milk, meat, and eggs for human consumption. India is number one milk producer in the world. It is producing about

**Table 1: Share of agriculture and livestock sector in GDP**

Year	GDP (Total)	(At current prices in ₹ Crore)			
		GDP (Agriculture)		GDP (Livestock)	
		₹	Per cent share	₹	Per cent share
2010-11	7266966	1132048	15.58	276105	3.80
2011-12	8353495	1268081	15.18	327838	3.92
2012-13	9388876	14174668	15.10	386246	4.11

Source: Anonymous, 2014

146.30 million tonnes of milk in a year. Similarly, it is producing about 74.75 billion of eggs, 8.89 million tonnes of meat in a year. The value of milk group and meat group at current prices was ₹406035 crores in 2013-14. The Table 3 gives detailed information about the products along with value.

**Table 3: Production of livestock products, 2014-15**

Product	Quantity	Ranking in world production
Milk in million tonnes	146.30	First
Eggs in billions (No.)	78.48	Third
Meat in million tonnes	8.89	-
Wool in million kg.	47.90	-
Fish in million tonnes	10.16	Second

Source: Anonymous, 2014-15

**Fibre and Skins:** The livestock also contributes to the production of wool, hair, hides and pelts. Leather is the most important product which has a very high export potential. India is producing about 47.9 million kg of wool per annum.

**Draft:** Bullocks are the back bone of Indian agriculture. Despite lot of advancements in the use of mechanical power in Indian agricultural operations, the Indian farmer especially in rural areas still depend upon bullocks for various agricultural operations. The bullocks are saving a lot on fuel which is a necessary input for using mechanical power like tractors, combine harvesters etc.

**Dung and other Animal Waste Materials:** Dung and other animal wastes serve as very good farm yard manure and the value of which worth several crores of rupees. In addition, it is also used as fuel (bio gas, dung cakes), and for construction as poor man's cement (dung).

**Storage:** Livestock are considered as "moving banks" or "personal ATM" because of their potentiality to dispose off during emergencies. They serve as capital and in cases of landless agricultural labourers many time it is the only capital resource they possess. Livestock serve as an asset and in case of emergencies they serve as guarantee for availing loans from the local sources such as money lenders in the villages.

#### Role of Livestock in Farmers' Economy

The livestock plays an important role in the economy of farmers. The farmers in India maintain mixed farming system i.e. a combination of crop and livestock where the output of one enterprise becomes the input of another enterprise thereby realize the resource efficiency. The livestock serve the farmers in different ways.

**Income:** Livestock is a source of subsidiary income for many families in India especially the resource poor who maintain few heads of animals. Cows and buffaloes if in milk will provide regular income to the livestock farmers through sale of milk. Animals like sheep and goat serve as sources of income during emergencies. The animals also serve as moving banks and assets which provide economic security to the owners.

**Employment:** A large number of people in India, being less literate and unskilled depend upon agriculture for their livelihoods. But agriculture, being seasonal in nature could provide employment for a maximum of 180 days in a year. The land less and less land people depend upon livestock for their earnings and income during lean agricultural season.

From our above discussion we can say that livestock sector is really an important source of income as it is useful in many different ways. Within the livestock, dairy sector is most significant. India's hold first position in milk production in the world i.e. India is the world's largest and fastest growing market for milk and milk products. Therefore, in order to double income of farmers, it is important to focus mainly on the dairy sector especially for small categories of farmers.

#### Significance of Dairy Sector

Doubling farmers' income is almost impossible without dairy. Dairy is a more equitable agri-occupation. 85 per cent of the small and marginal farmers in India own 45 per cent of the land, but own 75 per cent of the bovine (Planning Commission Report, 2007-12). For a landless person, dairying is one of the best occupation. It reduces the farmer's risk mitigate the strain when rains are not good, keep income flowing. Our aim is that the farmers' income comes throughout the year and not seasonally.

**Table 4: Value of major crops in India**

Commodity	Output (million tonnes)	Price (₹/kg)	Value of output (₹million)
Rice	106.65	21.69	2313.24
Wheat	95.85	15.24	1460.75
Cotton	6.103	42.39	258.71
Milk*	137.68	33.00	4543.44

Source: Directorate of Economics and Statistics (2013-14), DAC&FW. \*NDDB (2013-14)

The story of milk production growth is well known, from 22 million tonnes in 1970 to 146.30 million tonnes of milk in 2015 (NDDB, 2014-15). The monetary value of this is more than the current combined value of rice and wheat and this was achieved without subsidy and incentives as shown in Table 4.

Important element in the growth of dairy sector is the farmer institutions, which worked on three basic principles of 'trust, transparency and technology'. With a base of small farmers, we are 18 per cent of global production.

The dairy industry stands on four pillars. First is output. The dairy segment output is highest in value terms in the entire primary sector. To grow the primary sector, focus on where the value lies. Second is demand. As rural income rise, a progressively larger proportion will be spent on dairy products. Demand for milk will increase and production can grow in tandem. Third is employment. It has been mentioned that 70-75 million households are dependent on dairy farming. To enhance employment in

the rural areas, we have to look for a factor with the greatest potential. Focusing on dairy segment would help halt migration from rural to urban areas. Fourth is price. In 1988 or 1989, price was ₹2 for a litre of milk, which is around ₹33 today, quite clearly a big increase. If we are working in this segment there's a good chance that farmers' income will keep increasing, it will keep pace with inflation. Also when prices of agricultural products go up, there's a huge noise, but for dairy products nobody has ever complained about paying higher prices. Also this sector has the advantage of the presence of expertise, variety of products, large market and infrastructure. Unlike crops, there is no price volatility in case of milk. Dairy husbandry is a boon for small farmers, as a family with three cows or buffaloes can earn an annual income of ₹50000 to ₹60000, while conserving our precious native breeds. With stall-fed, high yielding animals, the dung availability will increase by 3 to 4 times, giving a boost to biogas and agricultural production. Therefore, there is a need to mobilize more people to the dairy sector.

### **CONCLUSIONS**

From the above discussion we conclude that great opportunities are there in livestock especially dairy sector and it will contribute in doubling the farmers' income if its potential is recognized. But this sector is not free from challenges, most serious issue in this sector is regional disparity. By regional disparity we mean that in states like Punjab, Haryana there are well known cross bred so milk production is up to mark but when we throw light upon Eastern India then still there people use to keep more of indigenous bred rather than cross bred so the milk production is low. Hence first of all in order to fulfill the dream of doubling farmers' income there is need to eliminate this regional disparity through awareness

programmes among the farmers. Then we have another issues of low productivity, which again emerge from some indigenous bred and also from our feeding challenges. Breed improvement, better feed and nutrition, animal health and better herd composition are important measures for raising livestock productivity. Another challenge is pressure on feed, fodder and water due to climate change. Processing and support infrastructure is also not adequate. Therefore these problems need to be solved by increasing the productivity, providing better feed and fodder on time and also by maintaining proper infrastructure facilities. In this way after meeting all these constraints there will be the possibility of doubling the farmers' income through livestock sector.

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## **A Study into the Marketing Efficiency of Eggs through Different Channels in Amritsar District of Punjab**

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### **ABSTRACT**

*The study examines the marketing efficiency of eggs in Amritsar district of Punjab. The eggs were primarily sold through three marketing channels. The maximum proportion of the total eggs produced was being sold through wholesalers i.e. 52, 64, and 80 percent of market surplus in the case of small, medium and large poultry farms. The proportion of eggs sold through retailers was less as comparative to wholesalers. The large farms preferred this channel relatively less because high risk of spoilage was associated as the produce was to be sold in lesser quantities. Further results revealed that the marketing efficiency of Channel-III was 16.73 which were higher than Channel-I and II by 13.02 and 11.77. So, the channel III for marketing of eggs was more efficient with higher producer share in consumer's rupee due to the removal of all intermediaries as compared to Channel-I and II. The problems faced by the poultry farmers were the lack of availability of raw materials, improved technology, health coverage, extension and training facilities, export facilities, transport and storage facilities and high feed cost and low egg prices. For improving the marketing of eggs, it was suggested that the number of intermediaries should be less, market infrastructure should be improved, storage and transportation facilities should be strengthened, more retail outlets, mass gathering and create awareness about the nutrient value of eggs to remove the inefficiencies in the marketing system.*

### **Keywords**

Eggs, marketing channels, marketing efficiency, price spread

### **JEL Codes**

C81, Q00, Q10, Q18

### **INTRODUCTION**

The poultry industry in India has emerged as the most dynamic and rapidly expanding segment of livestock economy from the production level touching about 40 billion eggs and 1 billion broilers with a compound growth rate of 8 per cent and 15 per cent respectively. Nearly 70 per cent of the total output of poultry industry is contributed by organized sector and remaining 30 per cent by unorganized sector. There are about 1000 hatcheries operating in the country. India's poultry industry represents a major success story, growing at about 20 per cent annually and the domestic poultry market is currently estimated at about ₹49000 crore, with 2012 production reaching a record 3.2 million tons of broiler meat and 2.86 million tons of eggs (Ali, 2015).

India is the fifth largest producer of eggs and ninth largest producer of poultry meat in the world, producing 34 billion eggs and about 600,000, tons of poultry meat in

1999 (Mehta, 2002). Poultry sector in India has been growing at a much faster rate than other sector of the Indian economy and accounts for 100 billion rupees to the Gross National product (GNP). Despite such high growth rates in last two decades, the per capita consumption of egg and poultry meat was low with approximate 36 eggs and 0.7 kilogram of poultry meat in 2001.

In India, egg production is growing at an annual growth rate of over 8 per cent with over 2800 crore eggs produced in the state per year. According to the ASSOCHAM analysis, Andhra Pradesh accounted for the highest share of over 30 per cent in the total egg production across India, Tamil Nadu with a share of about 20 percent, produced 2000 crore eggs in each year. Maharashtra, Haryana, Punjab and West Bengal are other leading egg producing states in India but each has a share of less than 10 percent of the total egg produced in India. India exports over five crore eggs worth ₹250 crore each

year and winter season is the peak season for exports. Namakkal in Tamil Nadu is an egg export hub and accounts for over 90 per cent of the total egg exports (Sally, 2012).

In Punjab, the value of output from eggs increased from about ₹94 crore during 1990-91 to ₹495 crore during 2008-09. The per capita availability of eggs in Punjab was 141 eggs as compared to 43 eggs in India. Due to limited scope of further addition to net area sown under crop farming in Punjab state and large indebtedness (89 percent farmer indebted with ₹50140 per hectare), only allied activities like poultry farming has acquired significance for solving the agrarian crisis of the state (Singh *et al.*, 2008).

There are many marketing problems including fluctuations of demand, breakage of eggs, price fluctuations and lack of transportation facilities. Outbreak of diseases; natural calamities and environmental pollution were identified as the major social and natural problems. Problems faced by intermediaries were poor communication and storage facilities, breakage of egg, price instability, unfavourable condition like hartal, strike, flood and natural calamities. The present system of marketing middleman shared a major part of consumer rupee and both producer and consumers are losers. Therefore, the present study was conducted to assess the marketing channels, marketing costs, marketing efficiency and marketing problems for different egg marketing channels in Amritsar (Singh *et al.*, 2010).

#### METHODOLOGY

The present study was undertaken during 2015-16. The study was undertaken in Amritsar District of Punjab as Amritsar District was purposively selected due to the reason that poultry farming adopted widely and commercially in this District. This study was based on multi stage sampling technique. Two blocks Verka and Majitha were selected purposively for the study as the number of poultry farms were the maximum in these areas. The complete list of all the layer poultry farms (for the purpose of egg production) in these areas was prepared along with size of the poultry farm.

Overall, 46 poultry farmers were taken for the study purpose, Around 30 poultry farmers were taken from Verka block and 16 poultry farmers were taken from Majitha block. These poultry farms were further classified into small, medium and large sized categories. The farms were classified as follows:-

Category	Number of birds
1. Small farms	Up to 5000 birds
2. Medium farms	5000 to 10000 birds
3. Large farms	Above 10000 birds

#### Price spread

The price spread refers to difference between the price paid by the consumer and the price received by the producer for an equivalent quantity at a given point of

**Table 1: Block wise distribution of sample households**

Category	Verkablock	Majitha block	Total
Small	17	8	25
Medium	7	4	11
Large	6	4	10
<b>Total</b>	<b>30</b>	<b>16</b>	<b>46</b>

*Figures in parentheses indicates the percentages to the total*

time in a specific market.

Price spreads were worked out at a single point of time between producing and consuming markets both during the peak and lean periods.

#### Marketing efficiency

Marketing efficiency was calculated by using Acharya's Index of marketing efficiency (Acharya and Aggarwal 1999) which is stated as

$$ME = \frac{FP}{(MC+MM)}$$

Where ME = Index of marketing efficiency  
 FP = Price received by the farmers  
 MC = Total marketing costs  
 MM = Net marketing margins

#### Producer's share in the consumer's Rupee

Producer's share in the consumer's rupee was calculated by the following formula.

$$P_s = (P_f/P_r) 100$$

$P_s$  = Producer's share in the consumer rupee

$P_f$  = Producer's price

$P_r$  = Retail's price

#### RESULTS AND DISCUSSION

##### Marketing Channels for Eggs

The marketing of eggs involves more complexities like high risk of breaking and spoilage, large fluctuations in prices and catering to the demand of consumers spread over a larger area. Due to above complexities, egg reaches to the consumer to the producer through a complex network of intermediaries which assume greater significance during egg marketing. In the study area, the survey revealed that eggs were primarily being sold through three marketing channels. The details of marketing channels have been given below:

1. Producer-Wholesaler/ commission agent-Retailer- Consumer.
2. Producer-Retailer-Consumer
3. Producer-Consumer

##### Marketing Channels followed by poultry farms

###### Wholesalers

The maximum proportion of the total eggs produced was being sold through wholesalers. The proportion of marketed surplus of eggs sold through the wholesaler was 52, 63.64 and 80 per cent on small, medium and large farms, respectively (Table 2). It was due to quick disposal of the eggs through wholesalers that the poultry farmers preferred selling through this channel. Eggs being perishable, the quick disposal helps to reduce the farmer's risk.

**Retailers**

The proportion of eggs sold through retailers was 28.00, 18.18 and 10 per cent on small, medium and large farms (Table 2). The possible reason for selling through this channel was higher share of producer in consumer's rupee. The large farmers preferred this channel relatively less because higher risk of spoilage associated as the produce was to be sold in lesser quantities.

**Consumers**

About 20, 18.18 and 10 per cent of the marketed surplus of eggs was sold directly to the consumers on small, medium and large farms, respectively (Table 2). Although, it was the least preferred channel because of very high risks of spoilage and breakage yet it ensured the producer's highest share in consumer's rupee. The risk was high as the entire marketing effort was done by the producer and quantity being sold was in lesser volumes.

**Channel-I: (Producer-Wholesaler-Retailer-Consumer)**

The perusal of Table 3 depicts the various costs and margins involved in egg marketing through Channel-I (Producer-Wholesaler-Retailer-Consumer). The results envisage that the net share of the producer in consumer's rupee was 78.78 per cent. The producer incurred ₹18 per hundred eggs for their marketing cost which involved the expenses on packaging, breakage, spoilage, labour and other components. The producer's marketing costs occupied 3.63 per cent share in consumer's rupee increasing his gross share to 82.42 per cent.

**Table 2: Marketing channels adopted for sale of eggs by organized poultry farms in Punjab, 2015-16**

Marketing intermediary	Small farms	Medium farms	Large farms	Overall
Wholesalers	13 (52.00)	7 (63.64)	8 (80.00)	28 (60.86)
Retailers	7 (28.00)	2 (18.18)	1 (10.00)	10 (21.74)
Directly to consumers	5 (20.00)	2 (18.18)	1 (10.00)	8 (17.40)
Total	25 (100.00)	11 (100.00)	10 (100.0)	46 (100.00)

Figures in parentheses indicates the percentages to the total

The wholesaler while selling the eggs to retailers incurred ₹10.50 on transportation, breakage and spoilage, labour and other components. The share of the cost incurred by wholesaler (on transportation) breakage and spoilage, labour and others was 0.70, 0.80 and 0.60 per cent of the consumer rupee, respectively. The marketing margin of wholesaler was ₹26.50 which was 5.35 per cent of consumer rupee. The retailer incurred higher costs while marketing to the consumer. He expanded ₹15.50 for per hundred eggs sold.

The cost of transportation was ₹5 breakage and spoilage was ₹5.50 and cost of labour etc. was ₹5 per

**Table 3: Price spread, marketing costs and margins through Channel-I (Producer-Wholesaler-Retailer-Consumer) in Punjab, 2015**

Particular	₹ Per 100 eggs	Per cent to final price
Net price to producer	390	78.78
Cost incurred by producer	18	3.63
a) Package	6	1.21
b) Breakage and spoilage	7.50	1.51
c) Labour and others	4.50	0.90
Producer's sale price/wholesaler purchase	408	82.42
Cost incurred by wholesaler	10.50	2.12
a) Transportation	3.50	0.70
b) Breakage and spoilage	4	0.80
c) Labour and others	3	0.60
Wholesaler's Margin	26.50	5.35
Wholesaler's price/retailer purchase	445	89.89
Cost incurred by retailer on	15.50	3.13
a) Transportation	5	1.10
b) Breakage and spoilage	5.50	1.11
c) Labour and others	5	1.10
Retailer margin	34.50	6.96
Retailer sale price/Consumer price	495	
<b>Marketing efficiency</b>		<b>3.71</b>
<b>Price spread (per cent)</b>		<b>21.22</b>

hundred eggs. It is worth mentioning here that in the breakage and spoilage component the larger proportion of costs was due to breakage as the spoilage was not very large during the winter months. Retailer also incurred higher expenses on transportation which might be due to larger distance covered by him to reach the consumers. The distance between the producer and wholesaler may not be as large as the distance between wholesaler and retailer and the retailer and consumer. The retailer also received higher margin occupying 6.96 per cent share in the consumer's rupee. The reason for higher margins might be due to the higher risks of spoilage and breakage as the eggs reach the retailer at the final stage of marketing. Increased distance of transportation was also one of the reasons which increased the risk of breakage. Marketing efficiency of channel I was 3.71 with price spread of 21.22 per cent.

**Channel II: (Producer-Retailer-Consumer)**

The price spread along with costs and margins for eggs marketed through Channel-II (Producer-Retailer-Consumer) has been enumerated in Table 4. The net share of the producer in consumer's rupee was 83.23 per cent which was slightly more than his share in Channel-I (Producer -Wholesaler-Retailer). It clearly indicates the positive effect of reduction in the length of marketing channel on the share of the producer. The expenses on

**Table 4: Price spread, marketing costs and margins through Channel-II (Producer-Retailer-Consumer) in Punjab, 2015-16**

Particular	₹ Per 100 eggs	Per cent to final price
Net price to producer	412	83.23
Cost incurred by producer	18	3.63
a) Package	6	1.21
b) Breakage and spoilage	7.50	1.51
c) Labour and others	4.50	0.90
Producer's sale price/retailer purchase price	430	86.86
Cost incurred by the retailers on	17	3.43
a) Transportation	6.50	1.31
b) Breakage and spoilage	5.50	1.11
c) Labour and others	5	1.01
Retailer margin	48	9.69
Retailer sale price/ Consumer price	495	
<b>Marketing efficiency</b>		<b>4.96</b>
<b>Price spread (per cent)</b>		<b>16.77</b>

marketing incurred by the producer were same as in Channel-I. The expenses on marketing incurred by the producer were same as in Channel-I (₹18 per hundred eggs). The cost incurred by retailer was ₹17 per hundred eggs, little higher than that in Channel-I (Producer - Wholesaler - Retailer). It was due to more expenses on transportation (₹6.50 per hundred eggs). The higher expense on the transportation was due to the elimination of wholesaler from the marketing channel, which resulted into higher distance to be travelled.

The retailer's margin was ₹48 per hundred eggs, which accounted for 9.69 per cent of consumer's rupee. The retailer's margin in channel II was higher than in channel-I, which might be due to the reward for extra efforts put in by the retailer. However, non-benefits accrued to the consumer as a result of reduction of length of the marketing channel as he had to pay the same amount of ₹495.00 per hundred eggs as in Channel-I (Producer – Wholesaler - Retailer) and the marketing efficiency of this channel was 4.96 which was 1.25 more and price spread was 16.77 per cent which was less by 4.45 per cent than the Channel-II.

Thus, it could be concluded from the analysis that the elimination of wholesaler from the marketing Channel-II benefited both the producer and retailer as their share in consumer's rupee increased. However, the consumer could not derive any benefit as the advantages were fully apportioned by the producer and retailer and consumer had to pay the same amount in both the channels.

#### **Channel-III (Producer-Consumer)**

This was the shortest channel of egg marketing in which there was no intermediary involved. The various

costs and margins involved in the channel were presented in the Table 5. The perusal of the data revealed that the producer spent ₹26 on selling of hundred eggs.

The net share of producer in consumer's rupee was found to be 94.36 per cent, which was higher by 15.33 and 10.88 per cent as compared to that Channel-I and II, respectively. It clearly highlights the positive impact on producer's share. The consumer had to pay less as compared to that in Channel-I and II, respectively. Thus, it could be inferred from the estimates that the removal of all the intermediaries from the marketing channel helped to improve the returns of the producer as well as his share in consumer's rupee. It also benefited the consumer as he had to pay less for the same quantity. Marketing efficiency of this channel was 16.73 which were 13.02 and 11.77 higher than the Channel I and II and price spread was 5.64 per cent which was 15.88 per cent and 11.13 per cent lesser than Channel-I and II, respectively.

#### **Marketing Efficiency**

The perusal of Table 6 depicts the marketing efficiency of eggs through different channels. The results revealed that the consumer's purchase price in Channel-III (Producer-consumer) was higher as compared to Channel-I and II. The net price received by producer was higher in Channel-III (₹435) as compared to Channel-I (₹390) and Channel-II (₹412). The total margins of intermediaries was nil among Channel-III but the total margins was higher in Channel-I (74.90). Total marketing costs (44 per cent) was higher in Channel-I as compared to Channel-II and III. The further results revealed that the producer's share in consumer's rupee was higher in Channel-III (94.36 per cent) as compared to Channel-I (78.28 per cent) and III (83.23 per cent). So the marketing efficiency was higher in Channel-III (16.73) as compared to Channel-I (3.71) and Channel-II (4.96)

#### **Problems faced by Poultry Farmers**

An opinion survey was carried among the sampled respondents to know the problems faced by the poultry farmers. Various problems were faced by the respondents

**Table 5: Price spread, marketing costs and margins through channel III (Producer-Consumer) in Punjab, 2015-16**

Particular	₹ Per 100 eggs	Per cent to final price
Net Price to producer	435	94.36
Cost incurred by producer on	26	5.63
a) Package	6	1.30
b) Breakage and spoilage	7.50	1.62
c) Labour and others	4.50	0.97
d) Shop rent	5	1.08
e) Other costs	3	0.65
Producer's sale price/ Consumer price	461	
<b>Marketing Efficiency</b>		<b>16.73</b>
<b>Price spread (Per cent)</b>		<b>5.64</b>

**Table 7: Problems faced by poultry farmers in the study area**

Problems	(Multiple response)				Rank
	Small (n <sub>1</sub> =25)	Medium (n <sub>2</sub> =11)	Large (n <sub>3</sub> =10)	Total (N=46)	
Lack of availability of raw materials	7 (28.00)	3 (27.27)	2 (20.00)	12 (26.08)	11 <sup>th</sup>
Lack of improved technology	5 (20.00)	3 (27.27)	3 (30.00)	11 (23.91)	12 <sup>th</sup>
Lack of control measure	8 (32.00)	3 (27.27)	5 (50.00)	16 (34.78)	8 <sup>th</sup>
High feed cost and low egg prices	13 (52.00)	7 (63.63)	6 (60.00)	26 (56.52)	1 <sup>st</sup>
Lack of transport/storage facilities	7 (32.00)	4 (36.36)	3 (30.00)	14 (30.43)	9 <sup>th</sup>
Lack of investment	9 (36.00)	6 (54.54)	7 (70.00)	22 (47.82)	3 <sup>rd</sup>
Labour problem	12 (48.00)	6 (54.54)	5 (50.00)	23 (50.00)	2 <sup>nd</sup>
Lack of power supply	10 (40.00)	4 (36.36)	4 (40.00)	18 (39.13)	6 <sup>th</sup>
Lack of feed and marketing	10 (40.00)	5 (45.45)	6 (60.00)	21 (45.65)	4 <sup>th</sup>
Lack of export facilities	7 (28.00)	5 (45.45)	6 (60.00)	20 (43.47)	5 <sup>th</sup>
Lack of health coverage	6 (24.00)	4 (36.36)	3 (30.00)	15 (32.60)	10 <sup>th</sup>
Managerial problem	10 (40.00)	4 (36.36)	3 (30.00)	17 (36.95)	7 <sup>th</sup>
Lack of extension and training facilities	4 (16.00)	3 (27.27)	2 (20.00)	9 (19.56)	13 <sup>th</sup>

Figures in parentheses indicates the percentages to the total

**Table 6: Marketing efficiency of eggs through different channels in Punjab, 2015-16**

Particular	(₹ per 100 eggs)		
	Channel I	Channel II	Channel III
Consumer's purchase price	495	495	461
Net price received by producer	390	412	435
Total marketing costs	44	35	26
Total margins of intermediaries	61	48	0
Producer's share in consumer's ₹(In percent)	78.78	83.23	94.36
Marketing efficiency	3.71	4.96	16.73

in the study area. Ranks were assigned in accordance to the problems faced by them. Around 52 per cent small, 63 per cent medium, 60 per cent large poultry farmers reported high feed cost and low egg prices as the major problem. The second problem faced by poultry farmers was labour shortage.

Overall 50 per cent farmers reported labour shortage is

second main problem being faced by respondents. Other major problems were investment problems, lack of feed and marketing, lack export facilities, lack of power supply, managerial problems, lack of control measure, lack of health coverage, lack of transport and storage facilities, lack of availability of raw materials, lack of improved technology, lack of extension and training facilities (Table 7).

#### CONCLUSIONS

The maximum proportion of the total eggs produced was being sold through wholesalers. It was due to quick disposal of the eggs through wholesalers that the poultry farmers preferred selling through this channel. Eggs being perishable, the quick disposal helps to reduce the farmer's risk. Producer share in consumer's rupee was highest in channel III with higher marketing efficiency and lower price spread as compared to Channel-I and II. It clearly shows that Channel-III was more efficient in marketing of eggs due to the removal of intermediaries. The major problems being faced by poultry farmers were high feed cost, low egg prices, labour problem, investment, marketing facilities, export facilities, and lack of availability of raw materials.

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## **An Analysis of Marketing Aspects in Marine Fishing-Tharuvaikulam, Thoothukudi District, Tamil Nadu**

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### **ABSTRACT**

*The domestic fish marketing system in India is mainly carried out by private traders with a large number of intermediaries between producers and consumers. To study the marketing aspects like channels, cost and constraints of fishers with suggested measures for easy operation and regulation of fish marketing in Tharuvaikulam fishing village, Thoothukudi district was attempted to. The result revealed that, the calculated average commission charges for auctioning the fishes higher for MD mechanized sector when compared to other sectors. Lack of government support was found to be the prominent constraints with specific to marine fish marketing.*

### **Key words**

Constraints, fishing, marketing aspects

### **JEL Codes**

C82, O13, Q13

### **INTRODUCTION**

Fisheries sector plays an important role in the Indian economy. It contributes to the national income, nutritional security and in employment generation (Singaravelu & Nedumaran, 2012). Tamil Nadu has a coastline of 1,076 km covering 13 coastal districts and 591 fishing villages. An efficient marketing system is the one capable of moving goods from producer to consumer at the lowest cost consistent with the provision of the services that the consumer demand. However, the domestic fish marketing system in India is neither efficient nor modern and is mainly carried out by private traders with a large number of intermediaries between producers and consumers (FAO, 2001). Aswathy & Samad (2012) studied price behavior and marketing efficiency of marine fish in Tuticorin, Tamil Nadu. The study showed that involvements of too many intermediaries need to be curbed in order to increase the efficiency of fish marketing and ensure remunerative price to the fisherfolk. Insufficient capital, storage problems, spoilage of fish caught and declining catch are the major constraints found by the fishermen in artisanal fishing (Onemolease & Oriakhi, 2011). Furthermore, an

understanding of the constraints limiting the growth and development of the fish marketing sector is vital for the successful development of policies or programmes aimed at improving the performance of the fish marketing sector. Ganesh *et al.* (2008) studied domestic fish marketing in India in relevance to changing market structure, performance and policies. It stated that only a few states had a policy specifically aimed at fish marketing. Tharuvaikulam is one of the fishing villages of Thoothukudi district adopting eco-friendly fishing methods in marine capture fishing especially gillnet fishing method and has been successfully adopted by the fisher folk over years.

### **Objective of the Study**

- a) To study the marketing channel and related aspects exist in study area
- b) Calculate the marketing cost for fishermen.
- c) Identified marketing constraints find by fisherfolk.

### **MATERIALS AND METHODS**

The study was conducted in Tharuvaikulam fishing village, Ottapidaram taluk, Thoothukudi district. Fish

marketing covers all functions involved from the point of fish catch to the final disposal. In the present study analyses of marketing cost, marketing channel, marketing aspects to identify the marketing constraints for fishermen were the major objectives. Marketing costs include cost of transport from the sea to the sea shore and commission charge to auctioneer for auctioning the fish catch and marketing channel refers to the pathway through which the fish passes from fishermen to the ultimate consumer in the present study area. Total sample size of the study was 120 which were distributed as 30 for SD motorized, 30 for MD mototrised and 60 for MD mechanized sectors. The above stated samples were selected randomly for data collection in the present study. The collected data were tabulated and analysed using the appropriate statistical tools.

**Rank Based Quotient (RBQ)**

Rank Based Quotient (RBQ) was used to quantify the marketing constraints encountered by fishermen in marine fisheries. For calculating the Rank Based Quotient (RBQ) given by Sabarathanam (1988), the following formula was used.

$$R.B.Q. = \frac{\sum Fi[(n + 1) - 1]}{N \times n} \times 100$$

Where in,

Fi = Number of fishers reporting a particular problem under i<sub>th</sub> rank

N = Number of fishermen

n = Number of problems identified

Based on the mean scores for all the factors were arranged in descending order and the most important factor was ranked first and the least important problem was ranked as the last.

**RESULT AND DISCUSSION**

**Marketing Aspects of Marine Fish in the Study Area**

This landing centre had intermediaries like auctioneers, wholesalers, retailers and agents of exporters. The three main marketing channels observed in the study area is given below:

Fishermen → Auctioneer → Wholesaler → Retailer → Consumer

Fishermen → Auctioneer → Retailer → Consumer

Fishermen → Auctioneer → Export agent

Small and medium size fishes such as lethrinids, seers, barracuda, carangids, sardines, crabs, squid, shrimp and pomfrets were distributed through the channel 1 and 2. Large size tuna, seers, barracuda, mackerels, rays and sharks variety fishes flow through the channel 3.

**Marketing Cost of Marine Fishing**

The total marketing cost included both transportation cost and commission charges in fish marketing. The net price received by the fishermen consisted of the landing price after deducting the auction charges. In the study area, money lenders had the rights to auction the fishes if they availed credit. Unfortunately, all most all except very few fishermen borrowed money from the money lenders.

Due to the reasons of immediate availability of loan without any collateral, fishermen inclined towards these agents for instance support. This leads to involvement of auctioneer in marine fish marketing in the study area.

Transportation costs for fishermen of MD motorized and MD mechanized sector were ₹ 3,06,000 and ₹ 4,36,625 per year, respectively. For SD motorized sector

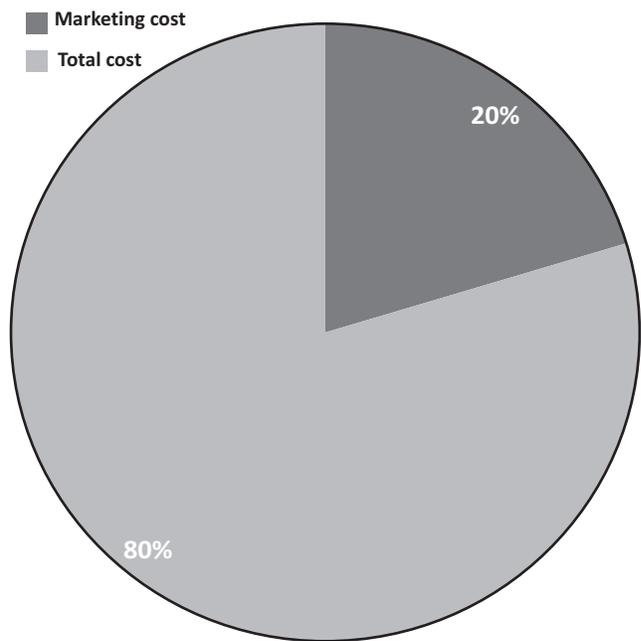


Figure 1: Marketing cost contribution in total costs - SD motorised sector

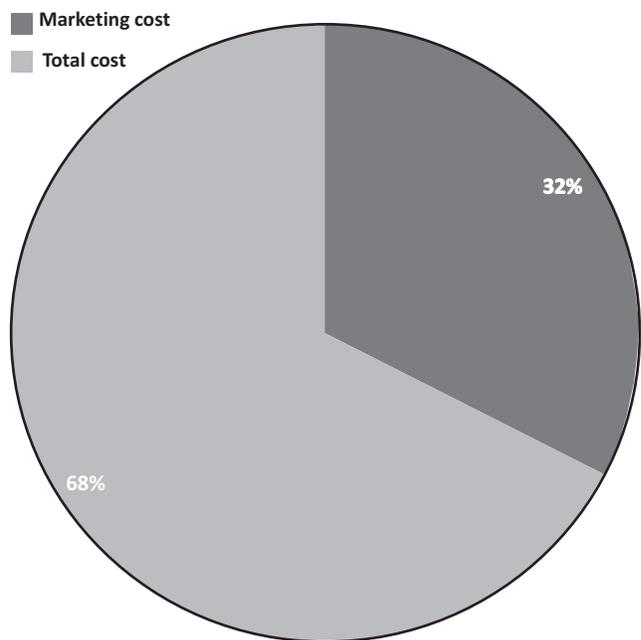
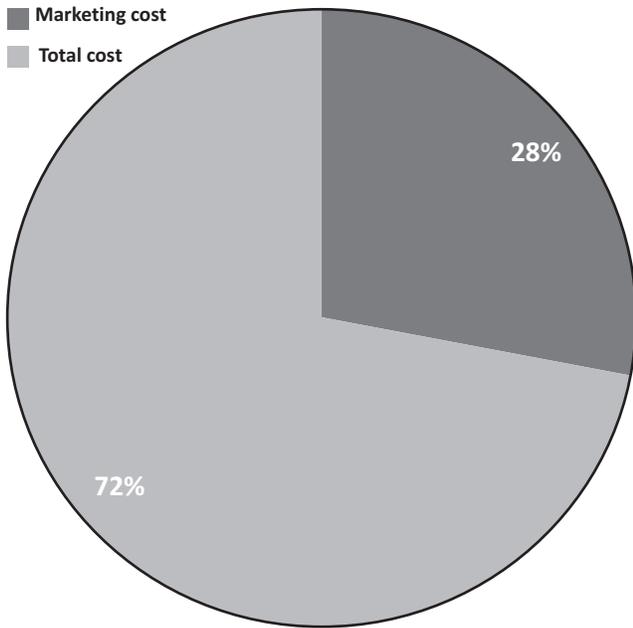


Figure 1: Marketing cost contribution in total costs - MD motorised



**Figure 1: Marketing cost contribution in total costs - MD mechanised**

no transportation costs was incurred as they reach shore area directly. Commission charges for auctioning fish catch of SD motorized, MD motorized and MD mechanized sectors were ₹ 1,90,920, ₹ 8,67,539 and ₹ 9,07,405 per year. Aswathy *et al.* (2014) recorded auction charges with a variation from 1 to 5 per cent depending on the amount of loan availed by fishermen from money lenders (Table 1). However, in the study area, the auction charges were fixed as 10per cent of the gross return or catch value irrespective of the amount availed as loan from money lenders.

Institutional finance for production and marketing will protect the fishermen from the clutches of money

**Table 1: Marketing cost of marine fishing per year**

Marketing cost	Motorized fishing crafts		Mechanized crafts
	SD fishing	MD fishing	MD fishing
	Transportation costs (₹)	0	3,06,000
Commission charges (₹)	1,90,920	8,67,539	9,07,405
Total cost (₹)	7,47,000	18,88,000	34,62,000

lenders and other intermediaries (Kumar *et al.*, 2013). Consequently, they do have rights to do own auction without any auction charge. The similar statement was reported in the earlier studies entitling marketing costs, margins and efficiency of domestic marine fish marketing in Kerala conducted by Aswathy *et al.* (2014). Ganesh *et al.* (2008) suggested that every fish merchant has to get a license to conduct business by paying an annual fee. All the fish commission agents and wholesaler-cum-retailers are to be registered with the directorate of fisheries of the state. A number of organizations and policies related to promotion of fish marketing in the country need to formulate a uniform market policy for fishes.

**Marketing Constraints**

The fishermen of three sectors such as SD motorized, MD motorized and MD mechanized encountered a large number of marketing related constraints which are listed in Table 2.

In the present study, as many as eleven marketing constraints were considered that would affect the fishermen namely lack of government support, high marketing cost, middleman interference, adequate price for catch, tide sale, uncertainty in price, lack of market information, lack of marketing knowledge, un-organized marketing, poor storage facilities at fish landing centre and lack of marketing infrastructure facility.

Rank based quotient (RBQ) technique was applied to

**Table 2: Marketing constraints of fishermen**

Factors	Motorized				Mechanized	
	SD fishing		MD fishing		MD fishing	
	M.S	Rank	M.S	Rank	M.S	Rank
Lack of government support	94.8	I	95.8	I	78.6	I
Inadequate price for catch	94.2	II	76.4	III	72.5	II
Middleman interference	82.1	III	92.4	II	68.1	III
High marketing cost	71.8	IV	68.8	IV	57.3	IV
Uncertainty in price	66.1	V	65.5	V	54.5	V
Tide sale	31.5	IX	61.8	VI	51.3	VI
Lack of market information	50.6	VI	17.6	X	46.8	VII
Lack of marketing knowledge	34.8	VIII	35.5	VIII	38.7	VIII
Un-organized marketing	46.7	VII	44.5	VII	35.2	IX
Poor storage facilities at fish landing centre	16.7	X	11.5	XI	25.9	X
Lack of marketing infrastructure facility	10.6	XI	30.3	IX	22.2	XI

M.S.: Mean score

rank the constraints faced by the fishermen during marketing. While ranking the constraints, lack of government support was the prominent constraint. Inadequate price for catch and middleman interference was also found to be the other major constraints for fishermen of SD motorized. For MD motorized and MD mechanized sectors, the major constraint in marketing was ranked similar to that of SD motorized sector *i.e.* inadequate price for catch, middleman interference and high marketing cost. The role of middlemen in fish marketing system was continuing unabated due to the absence of institutional involvement. Nevertheless, it has been observed that the share of middlemen in consumer's rupee has been coming down (Singaravelu and Nedumaran, 2012). Storage problem was the major constraint faced by the fishermen (Ali *et al.*, 2008; Kumar *et al.*, 2008). Sathiadhas & Narayanakumar (1994) recorded disorganized marketing structure, lack of adequate infrastructure, deterioration and wastage of fish during transportation and dominance of middlemen as the constraints of the fishermen. Lack of storage facility was not found as constraints due to non-availability of ice storage units and marketing facilities. Institutional finance for production and marketing will protect the fishermen from the clutches of money lenders and other intermediaries (Aswathy *et al.*, 2014). In the present study, lack of marketing infrastructure facility was found to be the least constraint faced by the fishermen of three sectors. Availability of ice bars for storage and preservation was not a constraint as the village had two ice storage units and 12 ice crusher units in the study area.

#### CONCLUSION AND POLICY SUGGESTIONS

The average transportation costs for fishermen of MD motorized and MD mechanized sector were estimated at ₹3,06,000 and ₹ 4,36,625 per year, respectively. For SD motorized sector no transportation costs was incurred as they reach shore area directly. Similarly, when compared three sectors the calculated average commission charges for auctioning the fishes caught from fishing higher for MD mechanized sector were ₹9,07,405 per year in the study area. Lack of government support, inadequate price, high marketing cost and middleman interference were found to be the prominent constraints with specific to marine fish marketing.

- Marketing cost could be minimized by evolving a co-operative fish marketing system with proper

price monitoring system in the market yard.

- Awareness programmes on savings would increase the saving capacity among the fisherfolk. It would help in meeting out day to day credit requirements of fishing operations. It will reduce the liability of fishermen.
- Establishment of Government fisheries cooperative societies or fishermen societies' taking part in marine fish marketing would help to reduce the auction fee and increase the marketing efficiency.
- An organized marketing system for marine fish marketing would help to reduce the marketing cost as well.
- This entire policy measure deals with the major problems for fishermen in the marine fish marketing.

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## Impact of Dairy Co-Operatives on Milk Production, Income and Employment in Jaipur District of Rajasthan

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### ABSTRACT

The results of the study clearly indicated that overall annual milk production was 6228.58 litres and 2443.35 litres as per farm and per milch animal in members of cooperative societies and 5068.28 litres, 2252.51 litres as per farm and per milch animal in non-members of cooperative societies. The overall annual income was higher (₹121515.56) in the member group than (₹92006.30) non-member group. The total annually per household employment generated of male labour was 84.53, 159.75 and 199.55 days as small, medium and large categories of members and 67.99, 116.69 and 164.70 days as small, medium and large categories of non-members respectively. In the case of female labour total employment generated were 164.39, 236.93 and 272.21 days as small, medium and large categories of members and 129.68, 180.45 and 217.89 days as small, medium and large categories of non-members respectively. It was also found that employment generated of female labour was higher than male labour across all the household categories of milk producers. The study noticeably indicated a positive impact of dairy cooperatives on the milk production, income and employment generation of milk producers in the study area.

### Keywords

Dairy cooperatives, employment, income, milk production, milk producers

### JEL Codes

C81, M33, Q13, Q18

### INTRODUCTION

The dairy sector is a very important productive activity in Indian agriculture, as milk is the second largest agricultural commodity contributing to GNP, next only to rice, and generates a regular flow of income to the farmer family throughout the year (Sarker & Ghosh, 2008). It is recognized as an important activity, suitable for employment generation and value addition in the agricultural sector in the Indian economy in general and Rajasthan in particular. According to the United Nations (2009) cooperatives continue 'to play significant social economic roles in many countries'. For example they "create employment and provide income, they produce and supply safe and quality food and services to their members, they promote solidarity and tolerance and they protect rights of each individual". Dairy farming is a labor-intensive work, which can generate employment opportunities for the rural poor, which is one of the main objectives of rural development. Milk producers get economic benefits in terms of increased productivity of milch animals, increased income level and improving

employment generation by better health care and management which may lead to increase human labour absorption and higher income to rural households.

### MATERIAL METHODS

For the present study, milk union Jaipur Zila Dugdh Utpadak Sahkari Sang Ltd. (JZDUSSL) was selected purposely as among all (21 numbers) milk unions functioning in Rajasthan, JZDUSSL union is one of the major milk union. Further, on the basis of the highest milk procurement. For selection of milk producer cooperative societies, a purposively sampling technique was used and 5 MPCS were selected purposively from each selected zone. All the milk producers were arranged in an ascending order with their herd size and were divided into three standard herd size groups viz., less than 2 milch animal as small, 2 to 4 milch animals as medium, and more than 4 milch animals as large sized farmers. A sample of 86 milk producer members and 34 milk producer non-members of MPCS were selected randomly with 10 per cent to the total number of all categories of members and non-members. Thus, total 120 milk

producers' members and non-members were selected for collection of primary data. The data were collected from July 2012 to June 2013.

**RESULTS AND DISCUSSION**

**Impact of Dairy Cooperatives on Milk Production, Income and Employment**

**Category-wise per farm and per animal annual milk production**

An important conclusion can be drawn from the Table 1 that per farm as well as per animal production of milk was observed to be higher at cooperative member farms in all the size groups under study.

Per farm total milk production as small, medium and large farms of cooperative members was 2479.65, 6739.08 and 15112.56 litres per annum respectively. Per farm production of milk for non-cooperative members for respective categories was 2310.42, 5591.40 and 10764.75 litres only. Similar findings were made by Kumar (1990); Mattigatti *et al.* (1990); Patil (1991); Cabrera *et al.* (2008). This shows a clear effect of dairy cooperative membership. Further, a slightly negative size productivity relationship was observed in the Table 1. Because large size farmers were not adequate supply of green fodder, concentrate and better health care per animal compared to small size farmers.

**Category wise income of dairy farmers**

A perusal of Table 2 gives a clear indication that per farm income is very high in dairy farmers associated with cooperatives in comparison of non-cooperative dairy farmers. The trend was observed irrespective of farm size.

Average income in cooperative dairy member farmers was observed to be ₹1, 21,516 whereas, income of non-cooperative member farmers was observed to be ₹92006. Average income of small farmers of cooperative members was ₹44871 which were higher than ₹35653 received in non-cooperative members. Similar observations were noted in all the categories. Similar results were reported by Kumar (1990); Thakur (1996); Kumar & Sharma (1999); Ramachandran (2004); Tuteja & Singh (2004); Sidhu & Bhullar (2004); Singh & Sharma (2006); Meena *et al.* (2009); Kiran & Kanani (2010).

The above figures revealed that the members of cooperative societies got high income than non-members. The higher income of cooperative members may be due to cattle feed supply, artificial insemination activities,

**Table 2: Annual incomes generated per household from dairy**

Class	Total income (₹)		
	Cooperative member	Non-cooperative member	Total
Small	44890.62 (55.73)	35652.78 (44.27)	80543.40 (100.00)
Medium	129663.15 (57.31)	96594.62 (42.69)	226257.77 (100.00)
Large	274434.03 (55.08)	223842.84 (44.92)	498276.87 (100.00)
Overall	121515.56 (56.91)	92006.30 (43.09)	213521.86 (100.00)

*Figures in the parenthesis indicate percentage to the total*

technical assistance programmers, training and extension activities, etc. by cooperative societies.

**Employment generation from dairy**

Activity wise employment generated in male and female in the cooperative and non-cooperative members in the study area are presented separately for male and female (Table 3 & 4).

**Male employment generated by dairy enterprise**

Male employment generated of cooperative and non-cooperative member farms is presented in table 3. Per household male employment was observed to be higher in all the farmer categories in cooperative members. In small farms male employment generated were 84.53 man days in cooperatives and 67.99 man days in non-cooperatives. Similarly 159.75 in medium and 199.55 man days in large farms male employment was generated to cooperative members.

Male employment generated at non-cooperative farms was 116.69 man days at medium farms and 164.70 man days' at large farms. No employment was generated in processing in small farm category whereas 13 to 23 per cent male employment was generated in medium to large category farms. It was found 139 man days per household in cooperatives and 105 man days in non-cooperatives.

Cooperative with respect to non-cooperative trend of female employment was similar to male employment. Female employment generated in cooperative member farms was observed to be higher compared to non-cooperatives. Total female employment is small, medium

**Table 1: Class-wise average annual per farm and per animal milk production**

Class	(L/annum)					
	Cooperative member		Non-cooperative member		Overall	
	Per farm	Per milch animal	Per farm	Per milch animal	Per farm	Per milch animal
Small	2479.65	2479.65	2310.42	2310.42	2425.99	2425.99
Medium	6739.08	2432.88	5591.40	2236.56	6456.57	2384.55
Large	15112.56	2387.45	10764.75	2152.95	13559.77	2303.70
Overall	6228.58	2443.35	5068.28	2252.51	-	-

**Table 3: Per household annual male employment generated from dairy**

Particulars	Employment (in days)							
	Cooperative members				Non-cooperative members			
	Feeding & management practices	Milking	Processing milk products	Total	Feeding & management practices	Milking	Processing milk products	Total
Small	48.07 (56.87)	36.46 (43.13)	0.00 (0.00)	84.53 (100.00)	38.83 (57.11)	29.16 (42.89)	0.00 (0.00)	67.99 (100.00)
Medium	77.96 (48.80)	53.16 (33.28)	28.63 (17.92)	159.75 (100.00)	59.36 (50.87)	41.87 (35.88)	15.46 (13.25)	116.69 (100.00)
Large	86.11 (43.15)	66.39 (33.27)	47.05 (23.58)	199.55 (100.00)	73.33 (44.52)	58.40 (35.46)	32.97 (20.02)	164.70 (100.00)
Overall	68.08 (48.97)	49.11 (35.32)	21.84 (15.71)	139.03 (100.00)	53.56 (50.95)	39.44 (37.52)	12.12 (11.53)	105.12 (100.00)

Figures in the parentheses indicate percentage to the total

**Table 4: Per household annual female employment generated from dairy**

Particulars	Employment (in days)							
	Cooperative members				Non-cooperative members			
	Feeding & management practices	Milking	Processing milk products	Total	Feeding & management practices	Milking	Processing milk products	Total
Small	54.78 (33.32)	31.82 (19.36)	77.78 (47.32)	164.39 (100.00)	42.23 (32.56)	24.61 (18.98)	62.84 (48.46)	129.68 (100.00)
Medium	75.51 (31.87)	52.22 (22.04)	109.20 (46.09)	236.93 (100.00)	56.23 (31.16)	38.60 (21.39)	85.62 (47.45)	180.45 (100.00)
Large	82.66 (30.37)	64.11 (23.55)	125.44 (46.08)	272.21 (100.00)	66.80 (30.66)	52.93 (24.29)	98.16 (45.05)	217.89 (100.00)
Overall	69.51 (32.03)	46.82 (21.58)	100.67 (46.39)	217.00 (100.00)	52.43 (31.48)	35.36 (21.23)	78.75 (47.29)	166.54 (100.00)

Figures in the parentheses indicate percentage to the total

and large farmers in cooperative farmers were observed to be 164.39, 236.93 and 272.21 women days respectively. The same values for non-cooperative farms were 129.68, 180.45 and 217.89. Women power generated was found to be 217 days in cooperatives and 166 days in non-cooperatives.

In context to the impact of dairy cooperative societies on employment generation, it can be revealed from the analysis that the members of dairy cooperative society having more opportunity in generation of employment in comparison of the employment of non-cooperative members. Similar findings were observed by Kumar (1990), Reddy (2000), Tuteja, & Singh (2004), Sharma and Sharma (2004), Sidhu & Bhullar (2004), Ramachandran (2004), Singh & Sharma (2006), Cabrera et al. (2008), Meena et al. (2009). These shows that dairy cooperative societies playing the important role in enhancing the employment through milk production in the study area.

## CONCLUSIONS

It is evident from foregoing discussion that milk producers in member group were better off compared to their counterparts in non-member group. The milk production, income and employment on member groups were higher than non-member groups and also found that women labour was more than men labour both the members and non-members of dairy cooperative society. Thus, the study suggested that Non-members milk producer need to motivate for membership of dairy cooperative societies. To fulfillments their income and employment.

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## Marketing Pattern and Price Spread of Fish in Haryana

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### ABSTRACT

The present study was carried out in the four divisions of Haryana state i.e. Gurugram (Gurgaon), Rohtak, Ambala and Hisar. From each division one district was selected on the basis of highest area and fish production. District Karnal, Kaithal, Hisar and Nuh (Mewat) were selected from each division. From each selected district, ten wholesalers and ten retailers of involved in fish marketing were selected from each market. The Channel-III (Producer Consumer) was found most efficient with the marketing efficiency 17.2, followed by Channel-II (Producer Retailer Consumer) and Channel-I (Producer Wholesaler Retailer Consumer) with marketing efficiency of 4.42 and 1.36 respectively. The Channel-III was found most efficient due to direct marketing by producers and very low marketing cost incurred thereon, but quantity of fish disposed off through this channel was on a limited scale. As far as marketing patterns was concerned, more than 70 per cent fish disposed of through Channel-I (Producer Wholesaler Retailer Consumer) whereas the fish producers received maximum share in consumer rupees through Channel-III (direct marketing by producers). Thus study concluded that there is pressing need to minimize or standardized the marketing functionalities between fish producers and consumers so that both fish producers as well as consumers could be directly benefited.

### Keywords

Market channel, market efficiency, market functionalities

### JEL Codes

C82, M33, O13, Q13, Q18

### INTRODUCTION

Fish farming has an important place in Indian economy. Besides a rich source of protein, it provides income and employment to millions of fishermen and farmers, particularly in the coastal states. Edible fish is also a rich source of animal protein and fish meal for livestock feeding. Fish scales and fishery waste are also a source of organic manure. In order to provide marketing support to fish producer's fishery department of Haryana has established three fish markets at Faridabad, Panipat and Yamuna Nagar. There is a provision of vehicles in these markets which are provided to fish farmers for transportation of their produce from pond site to the markets at the concessional rates. Developing marketing infrastructure such as retail vending kiosks, aqua shops, insulated/refrigerated vehicles, mini trucks, auto rickshaws with ice box, motor cycles/bicycles with ice box, fish display cabinets, visi coolers, weighing scales, computer units and allied equipments (Anonymous, 2015).

The fish farming has increased manifold in the state in

recent years. More than 80 per cent of the village ponds available in the state are under fish culture. Village panchayats are earning more than ₹125 crore every year from leasing the village ponds for fish farming. In addition to this, more than 2,500 pondunits have been constructed by the fish farmers in their own land. It shows that there is a significant progress in fish production over the decade but it has not achieved its target yet. There are many water bodies still available, which are not being used for any purpose. By using these water bodies for fish production, the food demand and economy of the state can be improved. To increase production, it is also necessary to improve the marketing system through the development of required infrastructure.

### MATERIALS AND METHODS

The present study was conducted in Haryana state. Department of Fisheries, Haryana has divided the whole state into four divisions i.e. Gurugram (Gurgaon), Rohtak, Ambala and Hisar. From each division one district was selected on the basis of highest area and fish production. From each selected district, ten fish farmers

were selected randomly. The primary data were collected from the farmers in the selected districts. For primary data collection, a sample of 40 fish producers, 10 farmers from each district i.e. Karnal, Kaithal, Hisar and Nuh (Mewat) were selected. Primary data were collected by conventional survey method on a well structured and pre-tested schedule through personal interview. Data regarding cost of production as well as returns from the fish farming were collected.

**Marketing pattern of fish:** Information regarding the marketing pattern/channels, marketing cost and price spread of fish were collected from the producers as well as various marketing agencies which involved in the marketing of fish through different channels. Information was also obtained from the market intermediaries, involved in the purchase of fish within the village and in the market.

**Marketing efficiency:** On the basis of agency-wise sale proceed; the major marketing channels were identified. To know the producer's share in consumer's rupee, all these costs and margins were expressed in percentage term. Marketing efficiency of each channel was estimated by Acharya approach method.

Marketing efficiency

$$MME = \frac{FC}{(MC+MM)}$$

Where,

MME= Modified measure of marketing efficiency

MC = Marketing

MM = Marketing margin

FP = Net price received by farmers

The ratio value of goods marketed to the cost was used as the measure of efficiency. The higher the ratio in a channel, the highest is its efficiency and vice versa.

## RESULTS AND DISCUSSION

### Price Spread, Marketing Margin and Efficiency of Important Marketing Channels

#### Marketing channels

Following three major marketing channels of fish marketing were identified in the study:

I - Producer Wholesaler Retailer Consumer

II - Producer Retailer Consumer

III - Producer Consumer

The result revealed that maximum fish were disposed of through Channel-I (Producer Wholesaler Retailer Consumer). An average figure was estimated to be 70.99 per cent of total fish marketing from Haryana in different markets of State as well in Delhi market followed by Channel-II (Producer Retailer Consumer) through which 24.33 per cent sold of the total produce to the consumers in the nearby market and in distant market, while least share were sold through Channel-III i.e. direct marketing by fish producers to the consumer contributed 4.68 per cent (Table I).

#### Marketing Efficiency in Various Channels

##### Channel-I

The marketing efficiency and price spread of fish

**Table 1: Marketing pattern of fish in Haryana**

Channels				Per cent in total
Producer	Wholesaler	Retailer	Consumer	70.99
Producer	Retailer	Consumer		24.33
Producer	Consumer			04.68
Total				100.00

marketing in the state through Channel-I are presented in Table 2. The results revealed that on an average the producer incurred ₹844.51 per quintal as marketing cost whereas marketing cost in districts like Karnal, Kaithal, Hisar and Nuh (Mewat) were observed ₹831.36, ₹869.40, ₹891.60 and ₹785.68 respectively. Major costs incurred by the farmers on packing material used during transportation were ₹480.20, ₹485.20, ₹470.35 and ₹475.80 in Karnal, Kaithal, Hisar and Nuh (Mewat) districts, respectively. The overall cost on packing material was ₹477.89.

The producer farmer overall received ₹6259.24 per q for his produce that accounted for 57.62 per cent of the consumer's price. The maximum price received by the farmer in Kaithal district (₹6375.60 per quintal) followed by Nuh-Mewat (₹6364.32), Karnal (₹6188.64 per q) and Hisar (₹6108.40 per q) respectively. On an average basis, marketing cost incurred by wholesaler was observed Rs. 1641.71 per quintal whereas highest marketing cost were incurred in Hisar district (₹1665.55 per q followed by Kaithal (₹1650.76), Nuh-Mewat (₹1630.24 per q) and Karnal (₹1620.30 per q), respectively. The highest net margin received by the wholesaler was observed in Hisar market i.e. 7.58 percent, followed by Karnal, Kaithal and Nuh (Mewat) districts. Finally, retailer sold the produce to the ultimate consumer. As far as retailers marketing cost was concerned, highest marketing cost was observed in Hisar (₹776.18) followed by Kaithal (₹701.57), Karnal (₹635.67) and Nuh-Mewat (₹566.21), respectively. The highest net margin received by the retailer in Karnal district (₹759.70 per q) which accounted for 6.90 per cent of the consumer's price followed by Hisar 673.82 (Kaithal), (₹648.43) and Nuh-Mewat (₹533.29), respectively.

As per marketing efficiency measure Nuh (Mewat) was found most efficient market (1.78) followed by Kaithal (1.38), Karnal (1.29) and Hisar (1.26) respectively. Similar study was conducted by Devi & Singh (2015).

##### Channel-II

The marketing efficiency and price spread of fish marketing in the state through Channel-II are presented in Table 3. It was observed from the table that highest net price received by the producers farmers from in Karnal district ₹7400 per q followed by Hisar (₹7320 per q), Nuh-Mewat (₹7280 per q) and Kaithal (₹7279.38 per q), respectively. The highest marketing cost incurred by the

Table 2: Marketing efficiency and price spread of fish marketing through channel-I

Particulars	Karnal		Kaithal		Hisar		Nuh (Mewat)		Average	
	₹/q	Per cent								
<b>Net price received by producer</b>	<b>6188.64</b>	<b>56.26</b>	<b>6375.60</b>	<b>57.96</b>	<b>6108.40</b>	<b>55.53</b>	<b>6364.32</b>	<b>60.61</b>	<b>6259.24</b>	<b>57.62</b>
Cost incurred by the producer										
1. Packing cost	480.20	4.36	485.20	4.41	470.35	4.27	475.80	4.53	477.89	4.39
2. Transportation charges	310.40	2.81	345.36	3.13	380.75	3.46	270.20	2.57	326.68	3.00
3. Loading and unloading charges	40.76	0.37	38.84	0.35	40.50	0.36	39.68	0.37	39.95	0.36
<b>Sub-total (1 to 3)</b>	<b>831.36</b>	<b>7.56</b>	<b>869.40</b>	<b>7.90</b>	<b>891.60</b>	<b>8.10</b>	<b>785.68</b>	<b>7.48</b>	<b>844.51</b>	<b>7.77</b>
Sale price of producer/purchase price of wholesaler	7020.00	63.81	7245.00	65.86	7000.00	63.63	7150.00	68.09	7103.75	65.39
<b>Cost incurred by wholesaler</b>										
1. Market fee & other charges	470.00	4.27	462.50	4.20	475.00	4.31	470.03	4.47	469.38	4.32
2. Loading and unloading charges	42.38	0.38	40.00	0.36	45.20	0.41	40.35	0.38	41.98	0.38
3. Grading & sorting	62.36	0.56	65.20	0.59	60.00	0.54	63.71	0.60	62.82	0.57
4. Spoilages	470.25	4.27	522.48	4.74	535.25	4.86	460.80	4.38	497.20	4.57
5. Storage	425.31	3.87	410.58	1.27	450.10	4.09	420.35	4.00	426.59	3.92
6. Other charges	150.00	1.36	150.00	7.74	100.00	0.90	175.00	1.66	143.75	1.32
<b>Sub-total (1 to 6)</b>	<b>1620.30</b>	<b>14.72</b>	<b>1650.76</b>	<b>15.00</b>	<b>1665.55</b>	<b>15.14</b>	<b>1630.24</b>	<b>15.52</b>	<b>1641.71</b>	<b>15.11</b>
<b>Net margin of wholesaler</b>	<b>759.70</b>	<b>6.90</b>	<b>754.24</b>	<b>6.85</b>	<b>835.45</b>	<b>7.58</b>	<b>620.26</b>	<b>5.90</b>	<b>742.41</b>	<b>6.83</b>
Sale price of wholesaler/purchase price of retailer	9400.00	85.45	9650.00	87.72	9500.00	86.36	9400.50	89.52	9487.63	87.34
Cost incurred by the retailer										
1. Transportation charges	140.64	1.28	175.64	1.59	150.00	1.36	120.85	1.15	146.78	1.35
2. Loading and unloading charges	24.78	0.22	25.18	0.22	25.50	0.22	25.36	0.24	25.21	0.23
3. Sorting & storage cost	220.25	2.00	210.55	1.91	250.68	2.27	200.00	1.90	220.37	2.02
4. Packing material	100.00	0.90	100.20	0.91	100.00	0.90	100.00	0.95	100.05	0.92
5. Other charges	150.00	1.36	200.00	1.81	250.00	2.27	120.00	1.14	180.00	1.65
<b>Sub-total (1 to 5)</b>	<b>635.67</b>	<b>5.77</b>	<b>701.57</b>	<b>6.37</b>	<b>776.18</b>	<b>7.06</b>	<b>566.21</b>	<b>5.39</b>	<b>669.91</b>	<b>6.16</b>
<b>Net margin of retailer</b>	<b>966.33</b>	<b>8.78</b>	<b>648.43</b>	<b>5.89</b>	<b>673.82</b>	<b>6.58</b>	<b>533.29</b>	<b>5.07</b>	<b>705.47</b>	<b>6.49</b>
Sale price of retailer/ consumer's purchase price	11000	100	11000	100.00	10950	100.00	10500	100	10862.50	100
<b>Marketing efficiency by Acharya method</b>		<b>1.29</b>		<b>1.38</b>		<b>1.26</b>		<b>1.78</b>		<b>1.36</b>

Table 3: Marketing efficiency and price spread of fish marketing through channel-II

Particulars	Karnal		Kaithal		Hisar		Nuh (Mewat)		Average	
	₹/q	Per cent								
<b>Net price received by producer</b>	<b>7400.00</b>	<b>80.43</b>	<b>7279.38</b>	<b>80.88</b>	<b>7320.00</b>	<b>81.33</b>	<b>7280.00</b>	<b>83.58</b>	<b>7319.85</b>	<b>81.54</b>
<b>Cost incurred by the retailer</b>										
1. Transportation charges	170.78	1.85	170.65	1.89	150.00	1.66	165.85	1.90	164.32	1.83
2. Loading and unloading Charges	25.50	0.27	23.41	0.26	25.50	0.28	28.20	0.32	25.65	0.28
3. Sorting & storage cost	220.63	2.39	250.38	2.78	320.85	3.56	215.40	2.47	251.82	2.80
4. Packing material	100.00	1.08	100.40	1.11	100.00	1.11	105.00	1.20	101.35	1.13
5. Other charges	120.00	1.30	175.78	1.95	200.00	2.22	100.00	1.14	148.95	1.66
<b>Sub-total (1 to 5)</b>	<b>636.41</b>	<b>6.91</b>	<b>720.62</b>	<b>8.00</b>	<b>796.35</b>	<b>8.85</b>	<b>614.45</b>	<b>7.05</b>	<b>691.96</b>	<b>7.71</b>
Net margin of retailer	1163.09	12.64	1000.00	11.11	883.60	9.82	815.20	9.35	965.47	10.75
Sale price of retailer/consumer's purchase price	9200.00	100	9000.00	100.00	9000.00	100.00	8709.65	100	8977.41	100
Marketing efficiency by Acharya method		<b>4.11</b>		<b>4.23</b>		<b>4.35</b>		<b>5.09</b>		<b>4.42</b>

retailers were observed in Hisar district (₹796.35 per q) followed by Kaithal (₹720.62per q), Karnal (₹636.41per q)and Nuh-Mewat (₹614.45per q) and that accounted 8.00, 6.91 and 7.05 per cent share of the total cost respectively.

In this marketing channel, again Nuh (Mewat) was observed most efficient market with marketing that ratio of 5.09 followed by Hisar, Kaithal and Karnal respectively. Similar results were observed by Ambulkar *et al.* (2015) from the study on fresh water fish marketing system of Bhoipura fish market which was largest wholesale market of Nagpur.

**Channel-III**

The marketing efficiency and price spread of fish marketing in the state through Channel – II are presented in Table 4. The result revealed that a producer received a net price of ₹8128.73 per q accounting for 94.53 per cent of consumer's price in Haryana as average of all the selected districts. The cost incurred by the farmer was ₹470.52 per q of the produce. Among the different districts namely, Karnal, Kaithal, Hisar and Nuh (Mewat) the share of the producer in consumer's rupee was 94.77, 94.40, 94.34 and 94.58 per cent, respectively.

Comparing the results, presented for different channels, it was observed that producer's share in consumer's rupee was more in direct sale in comparison among the other marketing channels which involving different market intermediaries. In the Channels-I, II and III, net prices of producer were found 57.62, 81.54 and 94.53 per cent of consumer's rupee. The producer's share in consumer's rupee was increased with decrease in the number of intermediaries between producer and consumer. The highest net price received by the producer in Channel-III (producer to consumer) was found to be 94.53 per cent in the state as a whole.

The marketing efficiency worked out of this channel was 17.28. The value much greater than 1 indicated an efficiency of market channel and complete absence of market middleman and market margin. Channel-III in transferring the produce from producer to consumer was a cheaper cost than value of goods. So, Channel-III was the most efficient among other marketing channels. Similar results were observed by the Kumar *et al.* (2008) in their study on domestic fish marketing in India-Changing structure, conduct performance and policies.

**CONCLUSIONS**

The present study was conducted in Haryana state. As per Department of Fisheries, Haryana is divided into four divisions namely, Gurugram (Gurgaon), Rohtak, Ambala and Hisar. From each division one district were selected on the basis of highest area and fish production. From each selected district, ten fish farmers were selected randomly. The primary data were collected from the farmers in the selected districts. For primary data collection, a sample of 40 fish producers, 10 farmers from each district i.e. Karnal, Kaithal, Hisar and Nuh (Mewat) were selected. Primary data were collected by

Table 4: Marketing efficiency and price spread of fish marketing through channel-III

Particulars	Karnal		Kaithal		Hisar		Nuh (Mewat)		Average	
	₹/q	Per cent	₹/q	Per cent	₹/q	Per cent	₹/q	Per cent	₹/q	Per cent
Net price received by producer	8339.80	94.77	8020.88	94.40	8019.25	94.34	8135.00	94.58	8128.73	94.53
Cost incurred by the producer										
1. Storage cost	360.20	4.09	370.54	4.36	380.75	4.48	365.40	4.24	369.22	4.29
2. Packing material	100.00	1.13	105.20	1.16	100.00	1.17	100.00	1.16	101.30	1.17
Sub-total (1 to 2)	460.20	5.22	475.74	5.29	480.75	5.65	465.40	5.41	470.52	5.47
Sale price of producer/consumer's purchase price	8800.00	100.00	8496.62	100.00	8500.00	100.00	8600.40	100.00	8599.26	100.00
Marketing efficiency by Acharya method		18.12		16.86		16.68		17.47		17.28

conventional survey method on a well structured and pre-tested schedule through personal interview. Data regarding cost of production as well as returns from the fish farming were collected. Appropriate statistical tools were used to draw the inference of the study. The Channel-III (Producer Consumer) was found most efficient with the marketing efficiency 17.2, followed by Channel-II (Producer Retailer Consumer) and Channel-I (Producer Wholesaler Retailer Consumer) with marketing efficiency of 4.42 and 1.36 respectively. The Channel-III was found most efficient due to direct marketing by producers and very low marketing cost, but disposed of fish through this channel was on a limited scale due to lower demand. As far as marketing patterns was concerned, more than 70 per cent fish disposed of through Channel-I (Producer Wholesaler Retailer Consumer) whereas the fish producers received maximum share in consumer rupees through Channel-III. Thus study concluded there is need to minimize or standardized the marketing factionaries between fish producers and consumers so that both fish producers as well as consumers could be benefited.

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## Building the Price Forecasting Model for Cotton Price in Kesinga Market Odisha, India

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### ABSTRACT

Agriculture development through cash crops is a sine qua non for economic growth of a state having an agrarian economy. Orissa is one of the most important states growing cotton under rainfed conditions in Kalahandi-Bolangir-Koraput (KBK) districts particularly in Kalahandi, Bolangir, Koraput Ganjam, Rayagada, and Nuapada. Cotton is the capital intensive crop in the state. Kalahandi (western Odisha) is the Black cotton soil zone and because of this, the quality of cotton is high comparing to other districts in the state. Kesinga is the leading cotton market in Kalahandi and it influences the cotton price in the state very well. So the need for forecasting the price of cotton in Kesinga emerges to give support to farmers and traders in planning and better marketing. The SARIMA model  $(1,1,1) (1,1,1)_{12}$  is selected as the best model for forecasting. The forecasted values were very much close to the actual values, and were very much helpful in improving the accuracy of forecasting. Seasonal index in the month of February shows the highest 107.82 and in the month of April it shows the lowest 89.61 in Kesinga market.

### Keywords

Cotton, Kesinga market, price forecasting, SARIMA model

### JEL codes

C01, C32, C53, C55

### INTRODUCTION

Agriculture sector needs 'well-functioning market' to drive growth, employment and economic prosperity. There is a need to help farmers in marketing their agricultural produce to fair price and to ensure remunerative returns to them. In the belt of black cotton soils of Odisha farmers grow cotton as an important cash crop. Odisha cotton is preferred by the traders/millers globally because of its quality. Kesinga is one among the leading cotton markets in Odisha. The wholesale price in Kesinga controls majority of cotton growing areas in the state. The technology used in cotton cultivation is fast changing and improved technology is very much capital intensive. On the other hand cotton price is very much volatile. Unless Market Intelligence especially price forecasting reaches farmers during pre-sowing and pre harvest the capital starved farmers will be prone to price as well as income risk. This will result in non adoption or least adoption of cutting edge technology and non-

competitive nationally and globally. Hence the need of designing appropriate forecasting model and price forecasting is prevalent.

In the Textile segment, Odisha has been one of the important cotton growing states in the country. Out of the total cotton cultivation area of Odisha, 80 per cent of the cotton is grown in the Kalahandi-Bolangir-Koraput (KBK) region. In the KBK area cotton is grown on approximately, around 1,30,000 hectares out of which 42,000 hectares are covered cotton crops. The seed cotton yield of Kalahandi alone is around 5 lakhs quintal every year. Kesinga is the leading cotton market in Kalahandi. Large number of spinning mills and traders group are concentrated there. The cotton price in Kesinga is very much influencing the state's price. Majority of the cotton farmers and traders are depending upon the aforesaid market price for marketing their produce. These situation leads to this study with the objective of price forecasting and developing good forecasting model for the Kesinga

market and also to find out it's seasonal Indices.

**MATERIALS AND METHODS**

For price forecasting of cotton price in Kesinga market, 132 monthly wholesale prices per quintal had been collected starting from January 2004 to December 2014. This had been collected from Regulated market committee Kesinga and Agmarknet website. 132 data points are very much reliable in the sense that minimum of 40 to 50 price figures are sufficient for forecasting. Using this forecasting for another 12 months can be carried on.

**Seasonal Autoregressive Integrated Moving Average (SARIMA) Model**

The fundamental fact about seasonal time-series with period S is that observations, which are S intervals apart, are similar. Therefore, the operation  $L(Y_t) = Y_{t-S}$  plays a particularly important role in the analysis of seasonal time-series. In general, the order of SARIMA model is denoted by (p,d,q) x (P,D,Q)<sub>s</sub>, and the model is represented as follows:

$$\Phi_p(L) \Phi_p(L^S) \theta_q(L) \Theta_q(L^S) \varepsilon_t$$

Where  $\Phi_p(L)$ ,  $\theta_q(L)$  are polynomials in L of degrees p and q respectively and  $\Phi_p(L^S)$ ,  $\Theta_q(L^S)$  are polynomials in  $L^S$  of degrees P and Q respectively. For estimation of parameters, iterative least squares method is used.

**Model building**

**Identification**

The foremost step in the process of modelling is to check for the stationarity of the series, as the estimation procedures are available only for stationary series. If the original series is non stationary then first of all it should be made stationary.

The next step in the identification process is to find the initial values for the orders of seasonal and non-seasonal parameters, p,q and P,Q. They could be obtained by looking for significant autocorrelation and partial autocorrelation coefficients.

**Estimation**

At the identification stage one or more models are tentatively chosen that seem to provide statistically adequate representations of the available data. Then we attempt to obtain precise estimates of parameters of the model by least squares following Box and Jenkins.

**Diagnostics**

Different models can be obtained for various combinations of AR and MA individually and collectively. The best model is obtained based on the following diagnostics.

**Low Akaike Information Criteria (AIC)/ Bayesian Information Criteria (BIC)/ Schwartz-Bayesian Information Criteria (SBC)**

AIC is given by  $(-2 \log L + 2m)$  where  $m=p+q+P+Q$  and L is the likelihood function. Since  $-2 \log L$  is approximately equal to  $\{n(1+\log 2\pi) + n \log \sigma^2\}$  where  $\sigma^2$  is the model MSE. Thus AIC can be written as  $AIC = \{n(1+\log 2\pi) + n \log \sigma^2 + 2m\}$  and since the first term in this equation is a constant, it is usually omitted while comparing the models. As an alternative to AIC,

sometimes SBC is also used as a criteria for model selection it is given by  $SBC = \log \sigma^2 + (m \log n)/n$ .

**Plot of residual ACF**

Once the appropriate ARIMA model has been fitted, one can examine the goodness of fit by plotting the ACF of residuals of the fitted model. If most of the sample autocorrelation coefficients of the residuals are within the limits i.e., in the range of  $\pm 1.96/\sqrt{N}$  where, N is the number of observations upon which the model is based then the residuals are white noise indicating that the model is a good fit.

**Non- significance of auto correlation of residuals via Portmonteau tests (Q- tests based on Chisquare statistics)- Box-Pierce or Ljung – Box tests**

After tentative model has been fitted to the data, it is important to perform diagnostic checks to test the adequacy of the model and, if need be, to suggest potential improvements. One way to accomplish this is through the analysis of residuals. It has been found that it is effective to measure the overall adequacy of the chosen model by examining a quantity Q known as Box-Pierce statistic (a function of autocorrelations of residuals) whose approximate distribution is chi-square and is computed as follows:

$$Q = n \sum r^2(j)$$

Where summation extends from 1 to k with k as the maximum lag considered, n is the number of observations in the series, r(j) is the estimated autocorrelation at lag j; k can be any positive integer and is usually around 20. Q follows Chi- square with (k-m1) degrees of freedom where m1 is the number of parameters estimated in the model. A modified Q statistic is the Ljung –box statistic which is given by

$$Q = n(n+2) \sum r^2(j) / (n-j)$$

The Q Statistic is compared to critical values from chi-square distribution. If model is correctly specified, residuals should be uncorrelated and Q should be small (the probability value should be large). A significant value indicates that the chosen model does not fit well.

All these stages require considerable care and work and they themselves are not exhaustive.

**Mean absolute percentage error (MAPE)**

The mean absolute percentage error (MAPE), also known as mean absolute percentage deviation (MAPD), is a measure of accuracy of a method for constructing fitted time series values in specifically in trend estimation. It usually expresses accuracy as a percentage, and is defined by the formula:

$$M = \frac{1}{n} \sum_{t=1}^n \left| \frac{A_t - F_t}{A_t} \right|$$

Where,  $A_t$  is the actual value and  $F_t$  is the forecast value. The difference between  $A_t$  and  $F_t$  is divided by the Actual value  $A_t$ , again. The absolute value in this

calculation is summed for every fitted or forecasted point in time and divided again by the number of fitted points  $n$  multiplying by 100 makes it a percentage error. In general a MAPE of 10 per cent is considered very well, a MAPE in the range 20-30 per cent or even higher is quite common.

**Seasonal Index**

A forecasting tool was used to determine demand for cotton in a given market place over the course of a typical year. Such an index was based on data from previous years that highlighted seasonal differences in production.

$$\text{Seasonal Index} = \frac{\text{The time series at time 't'}}{\text{Centred moving average at time 't'}}$$

**RESULTS AND DISCUSSION**

The perusal of Table 1 shows the AIC, AICc and BIC values for various forecasting models. The ARIMA model (1,1,1) (1,1,1)<sub>12</sub> is selected based upon considering the lowest AIC, AICc and BIC values and considering the ACF and PACF of the wholesale price series by comparing similar and close ARIMA models-ARIMA (1,1,1) (2,1,1)<sub>12</sub>, ARIMA (2,1,1) (1,1,1)<sub>12</sub>, ARIMA (2,1,2) (1,1,1)<sub>12</sub> and ARIMA (3,1,1) (1,1,1)<sub>12</sub> those satisfies the conditions like the sample autocorrelation coefficients of the residuals are within the limits and Ljung-Box tests. But their AIC, AICc and BIC values are greater than ARIMA model (1,1,1) (1,1,1)<sub>12</sub>. Naidu *et al.* (2014) examined red chilli prices in Khammam and Warangal markets of Andhra Pradesh were examined by SARIMA model and found ARIMA model (1,1,1) (1,1,1)<sub>12</sub> is the best model.

**Table 1: Selected measure of predictive performance**

Model	AIC	AICc	BIC
ARIMA (1,1,1) (1,1,1) <sub>12</sub>	12.83719	12.85595	11.92455
ARIMA (1,1,1) (2,1,1) <sub>12</sub>	12.84147	12.86171	11.95066
ARIMA (2,1,1) (1,1,1) <sub>12</sub>	12.84737	12.86762	11.95657
ARIMA (2,1,2) (1,1,1) <sub>12</sub>	12.86246	12.88445	11.99349
ARIMA (3,1,1) (1,1,1) <sub>12</sub>	12.8574	12.8792	11.98824

**Table 2: Parameters estimates of the ARIMA (1, 1, 1) model**

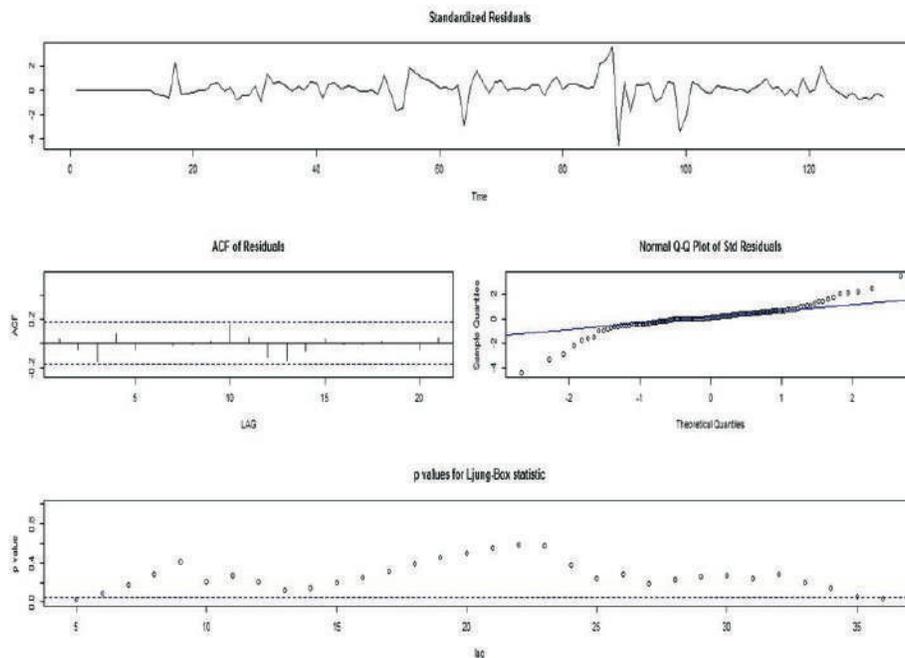
Parameters	Estimates	SE
AR1	0.5872	0.1188
MA1	-0.8869	0.0777
SAR1	-0.2370	0.0901
SMA1	-0.9998	0.1436

The perusal of Table 2 explains the parameters and their estimates and standard errors of the ARIMA (1, 1, 1) model. (AR1- autoregressive parameter of order 1, MA1-moving average parameter of order 1, SAR1-seasonal autoregressive parameter of order 1, SMA1-seasonal moving average parameter of order 1). MA1 had the lowest SE-0.0777 and SMA1 had the highest SE- 0.1436.

**MAPE Validation**

Mean absolute percentage error of the Kesinga market cotton price was observed as 14.58. This value was lower in the sense that forecasted values were very much close to the actual values, and was very much helpful in improving the accuracy of forecast (Paul, 2014).

The Figure 1 explains the Standardized Residuals,



**Figure 1: Standardized residuals, ACF of residuals, normal Q-Q plot of standardized residuals and p values for Ljung- Box statistic of ARIMA(1,1,1)(1,1,1)<sub>12</sub>**

ACF of Residuals, Normal Q-Q Plot of Standardized Residuals and p values for Ljung-Box statistic of ARIMA (1,1,1)(1,1,1)<sub>12</sub>.

The standardized residuals became stationary in the fitted model. Most of the sample auto correlation coefficients of the residuals were within the limits that is sign for good model.

Normal Quantile plot of standardized residuals were also fitted well. Majority of p values of all lags between 5 and 35 of Ljung-Box statistics were also above the limit. Thus these satisfied the condition of good fitted ARIMA model

Price forecasting of cotton price had been done by taking initially first 48 values and forecasted the next 12 values, after that taken 60 actual values and forecasted the next 12 likewise. From the forecast values obtained by the developed model (Table 3, 4, 5) and Figure 2, it can be said that in Kesinga market in 2015 forecasted cotton price will increase in February and reaches upto ₹4327.25 and after that shows a decrease in price level upto ₹4006.07 in April. During May, June and July there would

not be any price rise because of the rainy season. From August onwards there would be an increase in price in each month and it ranges from ₹4364.23 and it goes upto ₹4667.39 in December. Forecasting the future cotton prices can help both the farmers as well as the traders for future planning.

The perusal of Figure 3 gives an idea of the extent of forecasting of cotton price between the higher and lower significant levels.

The perusal of Table 6 reveals the seasonal index of wholesale cotton price in Kesinga market, Odisha. In the month of February it shows the highest index 107.82 and in the month of April it shows the lowest index 89.61. During the high humid period and rainy season in April, May, June and July the indices are in low values this is because of the high moisture content in the products hence quality loss occurs. From August onwards there shows an increase trend in the indices and it will reach high in December.

**CONCLUSIONS**

The SARIMA model (1,1,1)(1,1,1)<sub>12</sub> is selected based

**Table 3: Forecasts based on the fitted ARIMA (1,1,1)(1,1,1)<sub>12</sub> model for 2004 to 2007**

			(₹/q)		
Months	Actual	Forecasted	Months	Actual	Forecasted
<b>2004</b>			<b>2006</b>		
January	2225.98	-	January	2016.51	-
February	2400	-	February	2200.67	-
March	2341.37	-	March	1654.19	-
April	2350	-	April	1403.28	-
May	2000	-	May	1488.49	-
June	2016.665	-	June	1600	-
July	2024.9975	-	July	1100	-
August	2033.33	-	August	1849.59	-
September	1941.42	-	September	1935.01	-
October	1895.465	-	October	2042.505	-
November	1849.51	-	November	2096.2525	-
December	1866.51	-	December	2046.49	-
<b>2005</b>			<b>2007</b>		
January	1967.41	-	January	2150	-
February	1950.64	-	February	2150	-
March	1664.78	-	March	2150	-
April	1400	-	April	2150	-
May	2500	-	May	2160	-
June	2045.31	-	June	2165	-
July	1817.965	-	July	2167.5	-
August	1704.2925	-	August	2168.75	-
September	1647.45625	-	September	2169.375	-
October	1590.62	-	October	2169.6875	-
November	1831	-	November	2170	-
December	2128.41	-	December	2241.82	-

Table 4: Forecasts based on the fitted ARIMA (1,1,1)(1,1,1)<sub>12</sub> model for 2008 to 2011

			(₹/q)		
Months	Actual	Forecasted	Months	Actual	Forecasted
<b>2008</b>			<b>2010</b>		
January	2245.83	2245.79	January	3000	2961.02
February	2202.22	2365.83	February	3000	2951.20
March	2436.42	2044.06	March	3000	2891.43
April	2069.91	1856.64	April	3000	2468.63
May	1666.19	2196.70	May	2806.42	2543.65
June	1100	2074.32	June	2800	2448.89
July	1851.61	1807.22	July	3179.515	2598.40
August	2603.22	2045.07	August	3369.2725	2922.36
September	2801.61	2029.45	September	3464.15125	3024.27
October	2900.805	2034.73	October	3559.03	3098.58
November	3000	2129.41	November	3635.69	3140.81
December	2965.37	2220.77	December	3653.43	3181.76
<b>2009</b>			<b>2011</b>		
January	2941.18	2860.84	January	3690.28	3616.32
February	2908.61	2816.84	February	4489.04	3596.79
March	2761.08	2701.52	March	5000	3516.60
April	1400	2490.75	April	5487.58	2898.94
May	2100	2476.77	May	3325.56	3106.77
June	2800	2272.44	June	3683.2	3216.12
July	2700.5	2370.31	July	2934.82	3321.88
August	2601	2716.57	August	3517.41	3528.38
September	2800.5	2775.97	September	3808.705	3653.28
October	3000	2814.41	October	4100	3760.05
November	2900	2877.68	November	3703.06	3770.46
December	2991.57	2917.35	December	3648.6	3822.16

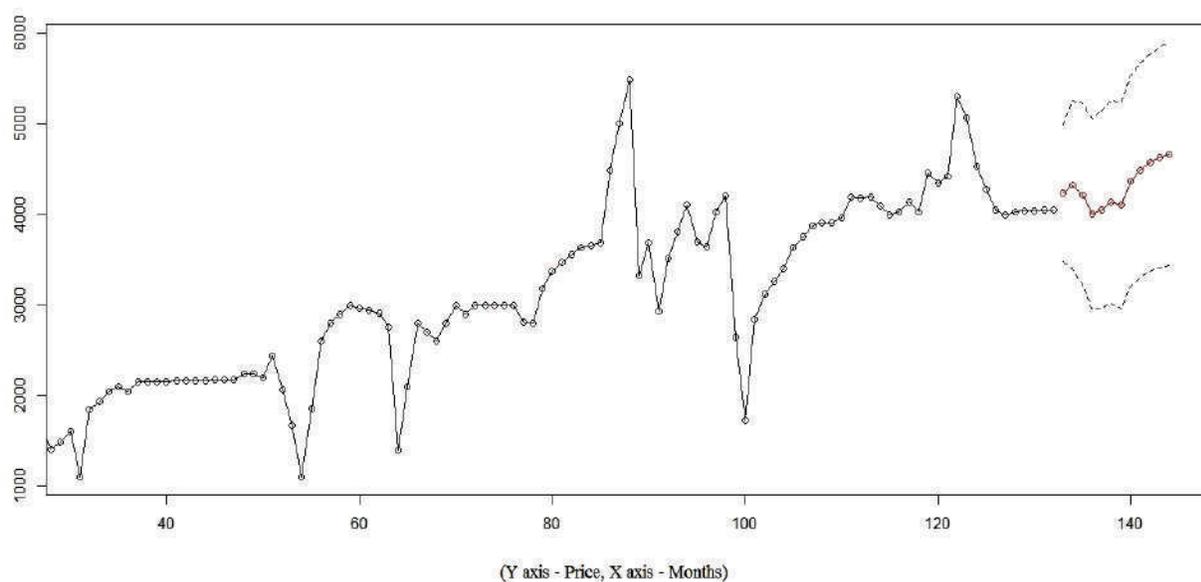


Figure 3: Fitted ARIMA model with data points

Table 5: Forecasts based on the fitted ARIMA (1,1,1)(1,1,1)<sub>12</sub> model for 2012 to 2015

(₹/q)					
Months	Actual	Forecasted	Months	Actual	Forecasted
<b>2012</b>			<b>2014</b>		
January	4031.91	3829.71	January	4417.77	4382.55
February	4200	4151.77	February	5300	4514.92
March	2648.44	4294.95	March	5065.75	4236.28
April	1727.43	4181.71	April	4531.25	3886.98
May	2838.19	3637.84	May	4280.58	3878.00
June	3119.095	3775.26	June	4053.02	3947.43
July	3259.5475	3670.09	July	4000	3922.11
August	3400	3988.22	August	4025	4204.08
September	3635.65	4143.88	September	4037.5	4315.84
October	3753.475	4291.72	October	4043.75	4437.09
November	3871.3	4203.50	November	4046.875	4384.29
December	3902.21	4221.03	December	4050	4453.16
<b>2013</b>			<b>2015</b>		
January	3910	3850.17	January		4234.74
February	3958.71	3962.04	February		4327.35
March	4186.41	4103.67	March		4216.75
April	4175.5	3960.88	April		4006.07
May	4190.29	3657.34	May		4054.29
June	4095.145	3644.73	June		4135.97
July	4000	3564.37	July		4103.51
August	4030.3	3844.37	August		4364.23
September	4135	3921.78	September		4490.64
October	4030.3	4008.14	October		4574.87
November	4459.98	3985.28	November		4633.35
December	4340.01	4033.84	December		4667.39

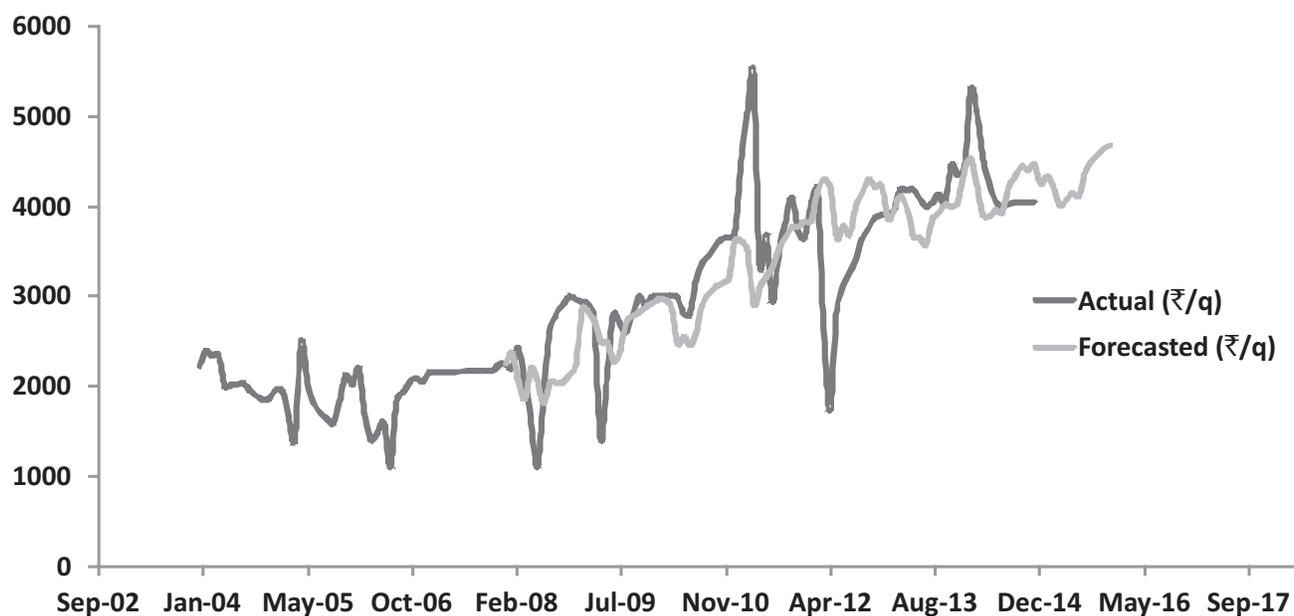


Figure 2: Actual VS forecasted values

**Table 6: Seasonal index of cotton price in Kesinga**

Months	Seasonal Index
January	103.70
February	107.82
March	101.38
April	89.61
May	93.99
June	92.74
July	90.76
August	99.68
September	102.82
October	104.64
November	106.08
December	106.78

upon considering the lowest AIC, AICc and BIC values and considering the ACF and PACF of the wholesale price series by comparing similar and close SARIMA models- SARIMA (1,1,1) (2,1,1)<sub>12</sub>, SARIMA (2,1,1) (1,1,1)<sub>12</sub>,

SARIMA (2,1,2) (1,1,1)<sub>12</sub> and SARIMA (3,1,1) (1,1,1)<sub>12</sub> those satisfies the conditions like the sample autocorrelation coefficients of the residuals are within the limits and Ljung-Box tests. But their AIC, AICc and BIC values are greater than ARIMA model (1,1,1) (1,1,1)<sub>12</sub>. Mean absolute percentage error of the Kesinga market cotton price was observed as 14.58 for SARIMA model (1,1,1) (1,1,1)<sub>12</sub>. This value was lower in the sense that forecasted values were very much close to the actual values, and was very much helpful in improving the accuracy of forecasting. Seasonal index in the month of February shows the highest 107.82 and in the month of April it shows the lowest 89.61.

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## Trade Potential in Livestock Sector: Evidences from Domestic and Global Level

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### ABSTRACT

Livestock being a supplementing source of farm income plays a multi-face role in socio-economic development of rural households. In spite of two consecutive drought years (2013-14 and 2014-15) which lead to decline in the share of crop, the share of livestock was increased to 4.4 per cent as compared to previous year (4.1 per cent). This may lead us to think about the latent opportunities of this sector. Present study was conducted with an aim to capture the dynamics of livestock sector at international level. The study is based on time series data i.e. obtained from FAOSTAT database for 1993-2013. Data was analysed using Simpson diversification index and export performance ratio. The results revealed that there is decline in the share of agriculture and livestock in total merchandise import however their contribution in export is increasing. Wool, Silk and Milk equivalent formed the major share of livestock imported to India, while Meat and meat preparation constituted major part in export. India remained net exporter of Eggs (in Shell and Liquid, dried), Meat and meat preparation, Offal, Honey and Live animals and net importer of Silk, Hair (fine), Skins (sheep, with wool) and Wool. Maximum variability in import was exhibited by Egg (liquid, dried) and for export was exhibited by offal. There is relatively more trade diversification in world than India except for T.E. 2008-10 and 2011-13. Import diversification in India is more than export diversification. India has comparative advantage in Eggs (Liquid, Dried), Meat and meat preparation, Silk, Offal and Honey. However India never had comparative advantage for Animal fat, Milk equivalent, Hair (fine), wool, Skins (sheep with wool) and Live animals.

### Keywords

Comparative advantage, diversification index, livestock, performance ratio, Simpson export

### JEL Codes

F14, Q17, P33, P45

### INTRODUCTION

Indian agriculture system is predominantly mixed farming system with livestock as a supplementing source of farm income. Contributing about 16 per cent to small farmer's income (Islam *et al.*, 2016). It plays a multi-face role in socio-economic development of rural households and has significant positive impact on equity in terms of income, employment and poverty reduction in rural areas as distribution of livestock is more egalitarian as compared to land (Ali, 2007). For nearly half of the workforce population (48.9 per cent) agriculture and allied activities remain the major source of livelihood (NSSO, 2011-12). The share of agriculture in GDP was 17.4 per cent in 2014-15 (Anonymous, 2016) as compared to previous year (18.3 per cent). The underlined

caused of this fall can be explained by two consecutive drought years (2013-14 and 2014-15). However the share of livestock is increased to 4.4 for the same year as compared to previous year 4.1 per cent on the other hand the share of crop was dropped by one per cent from 2013-14 to 2014-15. These figures may lead us to think about the latent opportunities of this sector.

The organic fertilizer produced by the sector is an important input to crop production, and dung from livestock is widely used as fuel in rural areas. Livestock also serves as an insurance substitute, especially for poor rural households; it can easily be sold during time of distress (Islam, 2016). Livestock sector is also an important source of foreign exchange. India's exports of Animal Products was ₹30,137.08 Crores in 2015-16

(APEDA). After Globalization and liberalization the market opportunities has been increased. There are chance to enhance the trade by improved domestic production, marketing efficiency and expanding in world market. India has the potential to become more competitive and may augment export of livestock products (Kumar, 2010).

The rising global demand for livestock products, various global trade negotiations and domestic reforms in India, have improved the access to international markets substantially. However, at the same time, apprehensions are being raised about the ability of Indian livestock farmers, a majority of whom are small and marginal, in taking the advantage of emerging opportunities, under the liberalized trade scenario (Sridhar & Shilpa, 2015). But before thinking about the expansion of trade one must reconsider the past performance at international level so that new dimensions can be touched. Therefore the present study was conducted with the aim to capture the dynamics of livestock sector at international level by studying the composition and trade performance of livestock sector, measuring the diversity in export and import and estimating comparative advantage of India's livestock sector.

**METHODOLOGY**

Livestock products are exported and imported in various forms e.g. live animals, as various products which includes Honey, beewax, egg, milk, meat and meat preparations, offals, wool, silk etc. In the present paper fourteen of these product forms were taken. The study is based on time series data (value, in terms of 1000 US\$) of exports/imports for India and world pertaining to period 1993-2013, collected from FAOSTAT (2016) database. The results were based on comparison among the triennium 1993-95, 1996-98, 1999-2001, 2002-04, 2005-07, 2008-10 and 2011-13. Simple descriptive statistical tools were used to study the composition of trade of livestock sector, for analyzing the trade performance of the live stock sector net export, compound annual growth rate and coefficient of variation were calculated. The

diversity in export and import of livestock was worked out using Simpson diversification index.

$$\text{Simpson Index} = 1 - \sum A_i^2 / A^2$$

Where,

$A_i$  = Value of export/import of  $i^{\text{th}}$  livestock product

$A$  = Value of export/import of total livestock products.

The value of the index varies from 0 to 1. 1 indicates total diversification, whereas a value of 0 indicates perfect concentration of trade towards a particular product in the particular triennium.

To measures the comparative advantage of India's livestock sector exports, Export Performance Ratio (EPR), as suggested by Balassa (1965) was used. The EPR of the  $i^{\text{th}}$  livestock product ( $EPR_i$ ) can be expressed as:

$$EPR_i = (E_i/CE)/(W_i/WE)$$

Where,

$E_i$  = Export of  $i^{\text{th}}$  livestock product from India

$CE$  = Aggregate export of livestock products from India

$W_i$  = Total world export of  $i^{\text{th}}$  livestock product  
 $WE$  = Total world export of total livestock products

A value of EPR greater than unity implies that India has comparative advantage in the exports of particular products and vice versa

**RESULTS AND DISCUSSION**

Table 1 depicts the share of agriculture and livestock in total merchandise trade from Indian and also shows the share of livestock in total agriculture trade. The share of agriculture and livestock in total merchandise import is decreasing while its contribution in export is increasing. Indicating increased self efficiency of the country and expansion in global market. Similarly the share of livestock in agricultural import is decreasing and its share in agricultural export is increasing. It contributes about 11 per cent of the total agriculture export from India in the triennium ending (T.E.) 2013.

Table 2 and 3 depicts the share of India in world's total import and export. Share of India in total world Import showed that India formed 0.28, 1.36 and 2.55 per cent of

**Table 1: Share of agriculture and livestock to total merchandise from India**

Years	Import			Export		
	Share of agriculture in total merchandise	Share of livestock in total merchandise	Share of livestock in agriculture	Share of agriculture in total merchandise	Share of livestock in total merchandise	Share of livestock in agriculture
1993-95	6.13	0.83	13.55	14.79	0.61	4.11
1996-98	6.90	0.54	7.87	16.21	0.70	4.32
1999-2001	7.02	0.51	7.31	11.71	0.77	6.55
2002-04	5.74	0.42	7.37	9.71	0.70	7.23
2005-07	3.75	0.24	6.41	9.86	0.83	8.39
2008-10	3.51	0.17	4.85	9.03	0.90	9.94
2011-13	3.99	0.15	3.71	12.15	1.35	11.10

**Table 2: Share of India in world import**

Products	(Percentage)						
	1993-95	1996-98	1999-01	2002-04	2005-07	2008-10	2011-13
Livestock	0.29	0.25	0.30	0.32	0.29	0.26	0.28
Agriculture product	0.45	0.61	0.82	0.85	0.87	1.02	1.36
Total merchandise	0.67	0.76	0.83	1.04	1.48	2.09	2.55
Beewax	0.06	0.10	0.18	0.27	0.26	1.35	1.55
Eggs (in Shell)	#	#	0.01	0.05	0.04	0.01	0.03
Eggs (Liquid, dried)	#	#	#	0.02	0.01	0.01	#
Meat and meat preparation	#	#	#	#	#	#	#
Animal fat	0.03	0.04	0.07	0.08	0.07	0.05	0.07
Milk equivalent	0.05	0.02	0.08	0.05	0.03	0.15	0.14
Silk	14.57	10.47	24.42	38.70	37.10	44.45	39.39
Offal	#	#	#	#	#	#	#
Hair(fine)	1.63	1.96	1.12	1.19	1.18	1.96	3.30
Honey (natural)	0.04	0.01	0.20	0.26	0.18	0.24	0.10
Silk-worm cocoons, reelable	0.84	0.08	0.82	2.13	1.62	0.16	#
Skins (sheep, with wool)	0.29	0.27	0.62	0.51	0.46	0.60	0.41
Wool	3.35	4.13	4.64	6.21	7.10	7.35	7.36
Live animals	0.01	0.01	0.00	0.01	0.03	0.05	0.05

# indicates negligible share

**Table 3: Share of India in World Export**

Products	(Percentage)						
	1993-95	1996-98	1999-01	2002-04	2005-07	2008-10	2011-13
Livestock	0.19	0.26	0.37	0.43	0.67	1.51	3.26
Agriculture product	1.03	1.23	1.19	1.21	1.64	3.13	6.04
Total merchandise	0.62	0.63	0.70	0.85	1.03	2.27	3.21
Beewax	0.33	0.34	0.66	0.39	0.75	0.80	1.51
Eggs (in Shell)	0.31	1.10	1.25	2.19	2.68	3.48	2.94
Eggs (Liquid, dried)	0.18	3.49	3.76	5.47	6.32	8.18	9.01
Meat and meat preparation	0.34	0.43	0.58	0.62	0.93	2.42	5.43
Animal fat	#	0.01	0.06	0.34	0.37	0.13	0.23
Milk equivalent	0.03	0.01	0.10	0.13	0.33	0.40	0.71
Silk	0.49	2.10	2.78	1.02	1.85	1.85	4.08
Offal	0.01	0.01	0.02	0.04	0.06	0.39	3.48
Hair (fine)	0.01	0.01	#	0.02	0.02	0.06	0.03
Honey (natural)	0.27	0.26	0.61	1.60	2.56	5.80	9.05
Silk-worm cocoons, reelable	#	0.28	1.58	8.07	8.31	0.56	0.38
Skins (sheep, with wool)	#	#	0.02	0.01	0.07	0.13	0.01
Wool	0.01	0.04	0.04	0.04	0.03	0.08	0.29
Live animals	0.07	0.01	0.02	0.04	0.06	0.13	0.10

# indicates negligible share

livestock, agriculture and total merchandise import of world respectively for T.E. 2013. The highest share was 39.39per cent for silk followed by 7.36 per cent of wool in T.E.2013 while share of egg (liquid and dried) and Silk-worm cocoons, reelable was negligible.

For T.E. 2013, India formed 3.26 and 6.04 in total world's livestock and agriculture export respectively, while the share of India in Total export of merchandise was 3.21. India constituted 9.05and 9.01 per cent of world's total export of honey and eggs (liquid and dried)

### Composition and Trend of Trade of Livestock

The perusal of Table 4 shows the composition of products imported livestock to India. It is found that Wool, Silk and Milk equivalent formed major share of livestock imported to India throughout the study period, constituting 49.93, 30.26 and 14.93 per cent of livestock imported to India respectively in T.E 2013, while the share of egg (liquid, dried) and Silk-worm cocoons, reelable in same T.E. was negligible.

Table 5 indicating the composition of products

exported livestock from India shows that the Meat and meat preparation formed a larger portion in livestock exported from India. For T.E. 2013 it constituted 86.65 Per cent of the total livestock exported from India followed by Milk Equivalent and offal whose shares were 6.59 and 2.08 per cent respectively. While the export of hair (fine) and Silk-worm cocoons, reelable was negligible for T.E. 2013. There exists a wide gap in the share of meat and meat preparation and milk equivalent.

**Trend in Net Exports**

The perusal of Table 6 shows the trend in net export of livestock from India during study period. India maintained the status of net exporter for Eggs (in Shell), Eggs (Liquid, Dried), Meat and meat Preparation, Offal, Honey and Live animals and net importer of Silk, Hair(fine), Skins (sheep, with wool) and Wool from 1993-2013. While for Beewax, Animal fat, Milk equivalent and

Silk-worm cocoons, reelable the status was changing besides Beewax the status change from net importer to net exporter. While for till T.E. 2007 India was net exporter of Beewax after which it became a net importer.

Table 7 reflects the compound annual growth rate of export and import value of livestock .It was found that export and import of Beewax, Eggs (in Shell), Meat and meat preparation, Milk equivalent, Silk, Offal and Wool had positive growth rate during the study period. While for Period 2004-13 import for Eggs (Liquid, Dried) and Honey experienced a negative growth rate. Import and export of Hair (fine) and live animal had negative growth rate for period 1993-2003.

**Variability in livestock Trade**

Table 8 shows coefficient of variation of export and imports of different livestock products in two sub-periods, i.e. from 1993 to 2003 and 2004 to 2013. For

**Table 4: Composition of Imported livestock to India**

Composition (I)	(Percentage)						
	1993-95	1996-98	1999-01	2002-04	2005-07	2008-10	2011-13
Beewax	0.01	0.02	0.03	0.03	0.03	0.17	0.23
Eggs (in Shell)	#	0.01	0.02	0.18	0.16	0.08	0.15
Eggs (Liquid,Dried)	#	#	#	0.02	0.02	0.01	#
Meat and meat preparation	0.01	0.02	0.10	0.13	0.35	0.72	0.73
Animal fat	0.16	0.24	0.34	0.32	0.31	0.28	0.34
Milk equivalent	4.72	2.90	7.61	4.99	3.43	16.39	14.93
Silk	39.12	27.34	43.73	39.51	39.12	35.23	30.26
Offal	#	#	#	#	0.01	#	#
Hair(fine)	1.85	1.68	0.66	0.45	0.46	0.52	0.91
Honey (natural)	0.06	0.02	0.35	0.65	0.35	0.61	0.25
Silk-worm cocoons, reelable	0.19	0.01	0.03	0.03	0.02	#	#
Skins (sheep, with wool)	0.52	0.85	0.93	0.98	0.60	0.67	0.66
Wool	52.82	66.63	46.06	52.47	54.18	43.72	49.93
Live animals	0.56	0.28	0.14	0.23	0.95	1.59	1.59

# indicates negligible share

**Table 5: Composition of exported livestock from India**

Composition (I)	(Percentage)						
	1993-95	1996-98	1999-01	2002-04	2005-07	2008-10	2011-13
Beewax	0.06	0.07	0.07	0.03	0.04	0.02	0.02
Eggs (in Shell)	1.85	5.34	3.85	5.88	4.63	2.66	1.04
Eggs (Liquid,Dried)	0.28	4.59	3.12	4.74	3.20	1.85	0.96
Meat and meat preparation	86.36	82.55	79.78	74.37	72.79	83.15	86.65
Animal fat	0.01	0.06	0.19	1.06	0.66	0.11	0.09
Milk equivalent	4.86	1.59	7.86	8.99	14.81	8.04	6.59
Silk	1.64	4.13	3.29	0.67	0.69	0.38	0.35
Offal	0.06	0.09	0.09	0.19	0.19	0.51	2.08
Hair (fine)	0.02	#	#	#	#	#	#
Honey (natural)	0.56	0.51	0.83	2.91	2.01	2.30	1.72
Silk-worm cocoons, reelable	#	0.03	0.05	0.08	0.03	#	#
Skins (sheep, with wool)	#	#	0.02	0.01	0.04	0.04	#
Wool	0.19	0.58	0.28	0.27	0.10	0.13	0.21
Live animals	4.14	0.48	0.58	0.80	0.82	0.81	0.29

# indicates negligible share

**Table 6: Net export (value) of livestock from India**

	(\$'000)						
Net export	1993-95	1996-98	1999-01	2002-04	2005-07	2008-10	2011-13
Beewax	73.67	115.67	158.33	50.00	247.67	-572.00	-963.00
Eggs (in Shell)	3064.33	12833.33	12413.33	26430.33	47195.67	46270.33	41669.00
Eggs (Liquid, dried)	456.00	11035.33	10094.00	21726.67	32976.67	32407.67	39579.00
Meat and meat preparation	143102.33	198618.00	258169.00	341558.33	751428.00	1454499.00	3550953.00
Animal fat	-376.00	-407.00	-275.00	3757.33	5479.67	419.67	1144.67
Milk equivalent	-3614.33	-2734.67	5494.00	24078.00	138226.00	54707.33	165598.00
Silk	-93992.67	-51903.00	-104073.33	-133378.00	-164272.67	-179070.00	-197961.00
Offal	91.67	206.33	290.00	871.67	1858.00	8883.67	85566.67
Hair(fine)	-4549.00	-3797.33	-1731.33	-1546.33	-2003.00	-2716.33	-6342.33
Honey (natural)	789.67	1181.33	1759.67	11139.00	19273.00	37099.33	69034.00
Silk-worm cocoons, reelable	-457.67	41.00	86.33	259.33	219.33	20.67	17.67
Skins (sheep, with wool)	-1277.00	-1914.33	-2370.00	-3321.33	-2225.67	-2866.33	-4571.67
Wool	-130264.33	-149343.00	-119954.67	-180021.67	-236364.00	-228089.00	-341436.67
Live animals	5486.00	501.67	1500.33	2856.00	4338.33	5827.00	586.00

**Table 7: Growth rate of export and import value of livestock**

Products	Import			Export		
	1993-2003	2004-13	1993-2013	1993-2003	2004-13	1993-2013
Beewax	0.18	0.29	0.28	0.09	0.22	0.15
Eggs (in Shell)	0.86 <sup>a</sup>	0.05	0.50 <sup>a</sup>	0.26	0.00	0.14
Eggs (Liquid, dried)	0.45 <sup>b</sup>	-0.05 <sup>c</sup>	0.03 <sup>b</sup>	0.96	0.11	0.45
Meat and meat preparation	0.43	0.27	0.37	0.13	0.33	0.21
Animal fat	0.17	0.09	0.12	0.50 <sup>i</sup>	-0.12	0.29 <sup>i</sup>
Milk equivalent	0.17	0.13	0.09	0.18	0.25	0.29
Silk	0.05	0.03	0.03	0.12	0.28	0.17
Offal	0.03 <sup>d</sup>	0.76 <sup>c</sup>	0.22 <sup>f</sup>	0.55	0.76	0.59
Hair(fine)	-0.06	0.18	0.05	-0.22	0.09 <sup>j</sup>	0.10 <sup>j</sup>
Honey (natural)	0.58	-0.08	0.31	0.47	0.20	0.32
Silk-worm cocoons, reelable	-0.15	0.26 <sup>e</sup>	-0.06 <sup>h</sup>	0.19 <sup>k</sup>	-0.27	-0.13 <sup>k</sup>
Skins (sheep, with wool)	0.10	0.01	0.03	-0.21 <sup>l</sup>	-0.16 <sup>m</sup>	0.22 <sup>n</sup>
Wool	0.04	0.06	0.05	0.18	0.21	0.18
Live animals	-0.06	0.32	0.11	-0.04	0.11	0.04

*A indicates growth rate from 1996, b indicates growth rate from 1994, c indicates from 2005, d indicates growth rate of 1996-2001, e indicates growth rate of 2005-07, f indicates of 1996-07, g indicates of 2005-09, h indicates of 1993-09, i indicates from 1995, j indicates from 2011, k indicates from 1998, l indicates from 2000, m indicates of 2005-12 and n indicates of 2000-12*

period 1993 to 2003, maximum import variability was exhibited by Egg (liquid, dried) followed by egg (in shell) and silk worm cocoons. However for period 2004-13 import of offal shows the maximum variability and minimum variability was showed by wool followed by eggs (in shell). From the period 1993-2013 minimum variability in import was showed by silk followed by wool and maximum variability was exhibited by silk-worm cocoons. Silk also shows minimum variability in export for the same period. Maximum variability in export for the period 1993-2003 and 2004-13 was showed by skin (sheep with wool) and offal respectively while for both the periods minimum variability was in eggs (in shell). For whole period i.e. from 1993 to 2013 maximum

variability in export was exhibited by offal.

#### Trade diversification

Diversification ensures stability in income by allocating risk. Diversification in export and import of livestock for world and India, which is measured by using Simpson diversification index is presented in Table 9. It is evident from results that there is relatively more diversification in world trade than India except for T.E. 2008-10 and 2011-13 in which the value of diversification index for import is higher for India than that of world i.e. 0.66 and 0.64 respectively.

For India import diversification is relatively more than export diversification. Export diversification was highest for T.E.2007. There is an increase in values of index for

**Table 8: Variability in export and import of livestock**

Products	(Per cent)					
	Import			Export		
	1993-2003	2004-13	1993-2013	1993-2003	2004-13	1993-2013
Beewax	72.43	87.71	150.00	65.63	64.54	81.90
Eggs (in Shell)	253.10	41.78	104.92	50.01	23.14	68.80
Eggs (Liquid, dried)	318.29	127.41	199.53	91.25	27.26	69.41
Meat and meat preparation	118.44	55.95	123.04	31.78	84.70	127.99
Animal fat	45.33	41.08	62.05	148.83	86.26	139.80
Milk equivalent	82.54	103.45	136.54	92.99	92.45	142.84
Silk	30.29	18.39	38.25	58.20	64.84	60.73
Offal	147.48	203.48	248.77	60.16	184.04	264.59
Hair(fine)	65.69	60.90	62.09	169.80	111.77	134.41
Honey (natural)	164.51	54.51	97.69	122.77	62.68	117.86
Silk-worm cocoons, reelable	207.80	191.59	255.91	115.34	101.11	110.35
Skins (sheep, with wool)	45.28	44.56	50.29	207.33	150.64	200.50
Wool	19.76	24.58	39.24	61.73	97.37	123.98
Live animals	55.33	56.84	111.69	89.53	39.19	73.11

**Table 9: Value of Simpson index**

Year	World		India	
	Import	Export	Import	Export
	1993-95	0.66	0.66	0.57
1996-98	0.66	0.65	0.48	0.31
1999-2001	0.65	0.64	0.59	0.35
2002-04	0.63	0.63	0.57	0.43
2005-07	0.63	0.62	0.55	0.44
2008-10	0.62	0.41	0.66	0.30
2011-13	0.63	0.41	0.64	0.24

export diversification of India from 1993 to 2007 after which it declined to 0.24 in T.E.2013.

It may be concluded that India should make necessary arrangement to enhance diversification of trade of livestock sector

#### Comparative Advantage of India's Livestock Export

The values of Export performance ratio (EPR) of India is presented in Table 10. For T.E. 2013 India has comparative advantage in Eggs (Liquid, Dried), Meat and meat Preparation, Silk, Offal and Honey. India also enjoyed advantage for these products during the whole study period besides for honey in which it lost its comparative advantage for T.E. 1998.

India enjoyed comparative advantage for Beewax from 1993 to 2001 and also for T.E. 2007 but from 2010 onwards it lost the grip and for eggs (in shell) it had comparative advantage besides for T.E. 2013.

For Silk-worm cocoons, reelable India had comparative advantage only from T.E.1998 to T.E. 2007. However India never had comparative advantage for Animal fat, Milk equivalent, Hair (fine), wool, Skins (sheep with wool) and Live animals. It is also revealed

**Table 10: Export performance ratio**

Product	1993-95	1996-98	1999-01	2002-04	2005-07	2008-10	2011-13
Beewax	1.72	1.30	1.77	0.92	1.12	0.53	0.46
Eggs (in Shell)	1.64	4.23	3.36	5.09	4.00	2.31	0.90
Eggs (Liquid, dried)	0.96	13.42	10.08	12.74	9.43	5.42	2.76
Meat and meat preparation	1.77	1.67	1.56	1.44	1.39	1.60	1.66
Animal fat	0.01	0.04	0.16	0.80	0.55	0.09	0.07
Milk equivalent	0.17	0.05	0.26	0.30	0.49	0.27	0.22
Silk	2.56	8.10	7.45	2.38	2.76	1.22	1.25
Offal	0.03	0.05	0.04	0.10	0.09	0.26	1.07
Hair (fine)	0.06	0.03	0.01	0.05	0.02	0.04	0.01
Honey (natural)	1.39	0.99	1.64	3.72	3.83	3.84	2.78
Silk-worm cocoons, reelable	0.00	1.08	4.24	18.80	12.41	0.37	0.12
Skins (sheep, with wool)	0.00	0.00	0.05	0.02	0.10	0.09	0.00
Wool	0.04	0.15	0.10	0.10	0.05	0.05	0.09
Live animals	0.37	0.05	0.06	0.08	0.09	0.09	0.03

**Table 11: Diversification of income sources of farmers**

Size of land possessed (ha)	Wages	Cultivation	Livestock	Non- farm business	Total	Index of diversification
<b>2012-13</b>						
Landless (<0.01)	64	1	26	10	100	0.52
Lower marginal (0.01-0.40)	57	17	15	11	100	0.61
Upper marginal (0.41-1.00)	38	41	12	9	100	0.66
Small	24	57	11	8	100	0.60
Semi-Medium (2.01-4.00)	15	69	11	5	100	0.49
Medium (4.01-10.00)	10	78	8	4	100	0.38
Large(>10.00)	3	86	6	4	100	0.25
All Size	32	48	12	8	100	0.65
<b>2002-03</b>						
Landless (<0.01)	78	1	5	17	100	0.36
Lower marginal (0.01-0.40)	60	18	6	17	100	0.58
Upper marginal (0.41-1.00)	40	43	6	11	100	0.64
Small	25	63	4	7	100	0.53
Semi-Medium (2.01-4.00)	18	75	2	6	100	0.41
Medium (4.01-10.00)	9	82	0	9	100	0.31
Large (>10.00)	6	86	1	7	100	0.25
All size	39	46	4	11	100	0.63

Source: Satyasai, 2016

from the table that that India has stable comparative advantage in the export of meat and meat preparation. Therefore it may be concluded that India should focus on meat and meat preparation.

#### Diversification of Income Sources of Farmers

Table 11 reveals that there is change in share of various source of farmer's income from 2002-03 to 2012-13. The share of livestock has been increased from 4 per cent in 2002-03 to 12 per cent in 2012-13. The major change was for landless farmer whose income share increased to 26 per cent in 2012-13 from 5 per cent in 2002-03. Medium farmers who barely think of livestock (0 per cent income share in 2002-03) start to consider livestock as an income source as there share increased to 8 per cent in 2012-13. Thus it can be concluded that livestock is emerging as an important source of income.

#### CONCLUSION

In the era of globalisation, the country should exploit the opportunities existing in the global market. It was found contribution in export is increasing indicating expansion in global market, but it was also found that there is relatively low export trade diversification; therefore efforts can be made in this direction. India ranks first in milk production, accounting for 18.5 per cent of world production (Anonymous, 2015-16), However, milk equivalent formed a major share of livestock product imported to India throughout the study period. Wool and Silk also formed the major share of livestock product imported to India, while Meat and meat preparation formed a larger portion in livestock exported from India. Honey and eggs (liquid and dried) contributed more than any other product in there respected world export. India

has comparative advantage in Eggs Liquid, Dried, Meat and meat Preparation, Silk, Offal and Honey, natural. However India never enjoyed comparative advantage for Animal fat, Milk equivalent, Hair, fine, wool, Skins sheep with wool and live animals. There should be efforts to increase comparative advantage in Animal fat, Milk equivalent, Hair, fine, wool, Skins sheep with wool and live animals. The farmers may consider silk, wool, egg, meat for increasing their income.

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## Diversification of Agricultural Crops to Adapt to Climate Change: A Case Study of Gujarat

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### ABSTRACT

Climate change is a global environmental challenge that is threatening sustainable development around the world. This paper looks at diversification as a key factor in reducing risk and means of coping with an uncertain climate. The time series data on area, production and productivity of major crops of Gujarat State were collected from the website [www.agri.gujarat.gov.in](http://www.agri.gujarat.gov.in) for the period from 2001-02 to 2014-15 and analyzed using different statistical tools like- CGR, Instability Index, Diversification Index, etc. This paper revealed that acreage under major food-crops like wheat and rice, most of cash crops and all the horticultural crops were increased whereas acreage under all coarse cereals, pulses, oilseeds was declined, which was mainly due to increase in rainfall (in cotton growing area), irrigation facility, high prices and introduction of Bt cotton variety. These all reasons were related to climatic factors directly or indirectly. High growth and low instability i.e. in case of major cereals, cash crops and horticultural crops shows risk security of farmers in terms of economic returns as well as in terms of climatic adaptation. Amongst the different regions, North Gujarat reported the highest level of crop diversification followed by Middle Gujarat, South Gujarat and Saurashtra-Kutch. The pre dominant crop like cotton and groundnut in Saurashtra-Kutch was responsible for low level of diversification in the region. Overall, Gujarat state reported a moderately high level of crop diversification but it was slightly declined during last decade, which secured farmers against climate risk.

### Keywords

Climate change, diversification, instability index, irrigation, sustainable development

### JEL Codes

Q01, Q15, Q19, Q54

### INTRODUCTION

Climate change is a global environmental challenge that is threatening sustainable development around the world. It is a continuing long-term process manifesting itself with gradual increase in temperature, greater variability in rainfall, rise in sea level and increased frequency, intensity and duration of extreme weather events, such as drought, flood, cyclone and storm surge (IPCC, 2007). In India, agriculture is inherently a risky venture due to uncertainty in production and volatility in price, and more so in the context of increased climatic aberrations and globalization. Therefore, there is a great need for diversification to provide food & nutrition security, economic support to farmers, stabilize farm income, induce farmers to invest in agriculture, environmental improvement and reduce indebtedness (Swain, 2014).

Adaptation is gaining attention as an inevitable answer to the challenges posed by climate change. The increasingly uncertain climatic conditions to which factors are exposed are becoming a constraint for their well-being (Werners *et al.*, 2012). Climate change has affected crops and livestock in a number of ways resulting in unstable productivity. This paper looks at diversification as a key factor in reducing risk and means of coping with an uncertain climate. This paper has identified different combinations of agricultural crops that reduce current and future climate related risks in Gujarat state and changes in the cropping pattern will provide the highest risk security. This paper assesses the growth of the agricultural crops area, production and productivity in Gujarat over a period of time.

### METHODOLOGY

**Data:** The time series data on area, production and

productivity of major crops of Gujarat State were collected from the website of Department of Agriculture and Cooperation, Government of Gujarat, Gandhinagar ([www.agri.gujarat.gov.in](http://www.agri.gujarat.gov.in)) for the period from 2001-02 to 2014-15 (for a period of 14 years). The data were compiled and analyzed using following statistical tools.

#### Statistical tools

**Compound Growth Rate (CGR):** The CGR was calculated by fitting the exponential function

$$(Y = ab^t)$$

Where, Y = area/production/productivity,

a = constant,

b = regression co-efficient,

t = time variable

CGR (per cent) was work out using following formula-

$$\text{CGR(per cent)} = (\text{antilog of } b-1) \times 100$$

#### Instability Index

The Cuddy Della Valle Index was used to correct the CV by:

$$\text{Instability Index (II)} = \text{CV} \times (1-R^2)$$

Where, CV = co-efficient of variation and

R<sup>2</sup> = co-efficient of determination from a time trend regression adjusted by the number of degrees of freedom

#### Classification of CGR and II

The high growth and low instability are prerequisites for sustainable agricultural performance.

CGRs and II	Classification
Low	Less than (Mean- Standard Deviation)
Medium	Between (Mean ± Standard Deviation)
High	Greater than (Mean + Standard Deviation)

#### Crop Diversification Indices

A variety of measures of crop diversification which indicate the extent of dispersion and concentration of activities in a given time and space by a single quantitative indicator have been used in the literature of agricultural diversification (Birthal, et al., 2007; Joshi et al., 2004; Kumar & Gupta, 2015; Shiyani & Pandya, 1998). The following indices were used in present study to measure the crop diversification.

**Herfindahl Index (HI):** It is a sum of the square of acreage proportion of each crop in gross cropped area. It can be calculated as under:

$$HI = \sum_{i=1}^N P_i^2$$

P<sub>i</sub> = Area under i<sup>th</sup> crop/ Gross cropped area

N = Number of crops

It is a measure of concentration. The value of HI is bounded by zero (perfect diversification) and one (complete specialization). Since HI is a measure of concentration, it is transformed by subtracting it from one i.e. 1-HI. The transformed value of HI will avoid confusion to compare it with other indices. Thus, transformed HI will increase with increase in diversification.

**Entropy Index (EI):** This index is widely used to measure diversification. It can be worked out as under:

$$EI = \sum_{i=1}^N P_i * \ln(P_i)$$

Unlike HI, the Entropy Index increases with increase in diversification. The upper value of the index can exceeded one when the number of crops is higher than the value of logarithm's base. It reaches a maximum value of ln (N) and reaches a minimum value of zero when there is only one crop i.e. in case of specialization. The limitation of EI is that it's upper value is not fixed. Since the upper limit of EI is log (N) (which depends on N), it can not be used to compare the degree of diversification in different locations where different number of crops are grown. This limitation overcome by modified Entropy Index.

#### Modified Entropy Index (MEI)

This index can be defined as under:

$$MEI = \sum_{i=1}^N P_i * \text{Log}N (P_i)$$

Hence MEI is same as EI except that the base of the logarithm is N. It takes a maximum value of one in case of perfect diversification and it attains a value zero in case of complete specialization. The MEI is superior to EI as it provides a uniform and fixed scale. The limitation of MEI is that it measures deviation from equal distribution among existing crops only and does not incorporate the number of crops involved in it. Therefore, it can be used to compare different situations with equal number of crops only.

#### Composite Entropy Index (CEI)

This index possesses all desirable properties of MEI and is used to compare diversification across situations having different and large number of crops since it gives due weight to the number of crops. The formula to calculate CEI is as under:

$$CEI = \sum_{i=1}^N P_i * \text{Log}N (P_i) * \left\{1 - \left(\frac{1}{N}\right)\right\}$$

$$CEI = MEI * \left\{1 - \left(\frac{1}{N}\right)\right\}$$

The CEI has two components viz., distribution and number of crops or diversity. The value of CEI increases with increase in number of crops or activities. The value of CEI ranges between zero and one.

These four different measures of crop diversification were used in the present study.

## RESULTS AND DISCUSSION

### Compound Growth Rates and Instability Indices

The compound growth rates (CGRs) and Instability Indices (IIs) were worked out for area production and productivity of major crops of Gujarat state for the period from year 2001-02 to 2014-15, which are presented in Table 1.

The results revealed that under total cereals area was increased non-significantly by 0.66 per cent while production and yield increased significantly i.e. 4.52 and 3.87 per cent respectively. There was highly significant rise in area (1.47 and 7.45 per cent), production (5.12 and

**Table 1: Compound growth rates and instability indices in area, production and productivity of major crops of Gujarat state, 2001-02 to 2014-15**

Crop	Area		Production		Productivity	
	CGR (per cent)	II	CGR (per cent)	II	CGR (per cent)	II
<b>Cereals</b>						
Rice	1.47***	5.86	5.12**	12.76	3.66***	10.57
Bajra	-5.41***	11.84	-0.9	21.12	4.51***	14.46
Maize	-0.69	9.82	-0.07	33.07	0.61	28.22
Jowar	-3.24	22.20	-0.78	21.15	2.47***	7.61
Wheat	7.45***	20.30	9.62***	26.25	2.17***	9.01
Total Cereals	0.66	10.63	4.52***	17.22	3.87***	9.16
<b>Pulses</b>						
Tur	-3.00***	7.29	0.71	11.48	3.71***	12.06
Gram	7.91***	27.80	13.15***	32.94	5.23***	12.03
Mung	-1.23	22.73	-0.68	28.36	0.55	17.96
Udad	-1.82**	9.43	0.69	19.47	2.44	14.98
Total Pulses	-0.68	13.02	3.05**	17.03	3.73***	10.44
<b>Oilseeds</b>						
Groundnut	-2.14***	8.78	1.42	46.12	3.55	42.90
Sesamum	-6.17***	15.94	-5.15**	29.69	1.03	21.69
Rapeseed	-1.49	19.84	0.63	25.61	2.13**	11.18
Castor	7.05***	21.58	9.6***	19.57	2.55	8.44
Total oilseeds	-0.48	6.67	3.57	31.67	4.05	27.58
<b>Cash crops</b>						
Cotton	4.13***	8.22	10.75***	27.07	6.6**	24.92
Tobacco	4.74	39.62	4.45	42.33	-0.24	8.31
Sugarcane	-1.75**	10.68	-1.95**	10.02	-0.19	6.86
Potato	7.94***	16.70	8.03***	21.75	0.12	10.05
Fennel	-1.08	33.07	0.63	33.49	1.68**	7.96
Cumin	6.83***	18.08	11.78***	21.50	4.94***	10.98
Chillies	5.19	57.51	-4.65	55.69	0.52	3.70
Isabgul	-1.38***	24.78	-12.4***	29.19	1.12	10.71
Onion	2.53	38.47	2.55	41.39	0.05	7.02
Garlic	2.70	50.69	1.77	54.87	-0.9	9.33
Guar	-0.63	31.94	1.86	57.98	2.48	29.06
<b>Horticultural Cops @</b>						
Fruits	3.34**	3.45	6.41**	5.73	3.07***	2.99
Vegetables	5.89**	5.05	8.32**	6.16	2.44***	2.15
Spices	2.05	10.65	5.6	20.00	3.55	15.52
Flowers	11.02**	7.19	15.71**	10.93	4.88***	8.07
Total horticultural crops	3.87**	4.17	7.45**	4.52	3.58***	4.09

\*\*\* and \*\* Significant at 1 and 5 per cent level

@ Results pertained to the year 2005-06 to 2014-15

9.62 per cent) and productivity (3.66 and 2.17 per cent) in rice and wheat. It may be due to increase in rainfall and irrigation facility during last years in the State. Other cereals like- bajra, maize and jowar showed decrease in area (5.41 per cent highly significant, 0.69 per cent non-significant and 3.24 per cent non-significant) as well as non-significant decrease in production (0.9, 0.07, and 0.78 per cent) respectively. The yield of coarse cereals like- Bajra and Jowar also increased significantly.

All pulses (Tur (-3.05 per cent), Mung (-1.23 per cent), Udad (-1.82 per cent) and total pulses (-0.68 per cent))

except gram showed negative growth in area. Gram was having highly significant rise in area (7.91 per cent), production (13.15 per cent) and productivity (5.23 per cent) respectively. The production and yield of total pulses was also increased significantly by 3.05 and 3.73 per cent, respectively. Tur, mung and udad showed slow or negative growth in production.

Groundnut, Sesamum, Rapeseed and total oilseeds showed negative growth in area. Castor's area and production was increased significantly by 7.05 and 9.6 per cent respectively due to its high demand in various

industries and high prices. There was positive growth in production (3.57 per cent) and yield (4.05 per cent) of total oilseeds in the state.

Under cash crops the area, production and yield of cotton was estimated to be 4.13, 10.75, and 6.6 per cent, while the figure for cumin were found to be 6.83, 11.78, and 4.94 per cent was increased significantly. The area and production of potato has increased by 7.94 and 8.03 per cent which show significant increase but yield growth was lower comparatively. The growth in area under other crops like- tobacco, chillies, onion and garlic was also positive. Significant decrease in area and production of Isabgul and sugarcane was also reported during the study period. The negative growth in yield for Sugarcane, Tobacco and Garlic was also observed.

In Gujarat state, the area under total horticulture crop was 1467 thousand ha during the year 2014-15. It showed highly significant increase in area, production and productivity. The respective figures for horticultural crops, fruits, vegetables and flowers during the last decade were estimated to be 15.71, 3.58, 3.07, 2.44, and 4.88 per cent. All CGRs were found highly significant except for spices area (2.05 per cent), production (5.6 per cent) and productivity (3.55 per cent).

So, in overall the area under pulses and oilseeds has declined over a period of 14 years, which was shifted towards major cereals (rice, wheat), cash crops (mainly cotton, castor and cumin) and horticultural crops showing diversification in Gujarat region. This can be defined through increase in rainfall (in cotton growing area), irrigation facility, high demand in various industries, high

prices and introduction of Bt cotton variety. These concerned reasons were related to climatic variables directly or indirectly.

#### Classification of crops

The crops with CGR were further categorized into low, medium and high CGR groups with their respective low, medium and high Instability Indices. This classification aims to identify crops having most desirable category *i.e.* high CGR with Low II. The least desirable category is Low CGR with High II. The results are presented in Table 2.

The results revealed that in all three parameters *viz.*, area, production and productivity, not a single crop was found fit for the most desirable category *i.e.* High CGR with Low II. A few crops like- gram, cumin and flowers were found in the category of High CGR with Medium II as well as a few crops like- fruits, vegetables and total horticultural crops were found in the category of Medium CGR with Low II. Majority crops were found in the category of Medium CGR with Medium II. Cotton is only one crop which found in the category of high CGR and High II for its yield.

The results further revealed that high growth and low instability *i.e.* in case of major cereals, cash crops and horticultural crops shows risk security of farmers in terms of economic returns as well as in terms of climactic adaptation.

#### Shift in Cropping Pattern

To know the shift in cropping pattern, temporal changes in acreage under different crops was worked out. The averages of the first TE 2003-04 and last TE 2014-15

**Table 2: Classification of positive and significant CGRs along with their respective categories of instability indices**

CGR	Instability Index		
	Low	Medium	High
<b>Area</b>			
<b>Low</b>	-	Bajra, Jowar, Sesamum	Chillies
<b>Medium</b>	Fruits, Total horticultural crops	Rice, Maize, Total cereals, Tur, Mung, Udad, Total pulses, Groundnut, Rapeseed, Total oilseeds, Cotton, Sugarcane, Isabgul, Guar, Spices	Tobacco, Fennel, Onion, Garlic
<b>High</b>	-	Wheat, Gram, Castor, Potato, Cumin, Vegetables, Flowers	-
<b>Production</b>			
<b>Low</b>	-	Sesamum, Isabgul	Chillies
<b>Medium</b>	Tur, Sugarcane, Fruits, Vegetables, Total horticultural crops	Rice, Bajra, Maize, Jowar, Total cereals, Mung, Udad, Total pulses, Rapeseed, Total oilseeds, Potato, Fennel, Spices	Groundnut, Tobacco, Onion, Garlic, Guar
<b>High</b>	-	Wheat, Gram, Castor, Cotton, Cumin, Flowers	-
<b>Productivity</b>			
<b>Low</b>	Chillies	Mung, Tobacco, Sugarcane, Potato, Onion, Garlic	Maize
<b>Medium</b>	Fruits, Vegetables, Total horticultural crops	Rice, Jowar, Wheat, Total cereals, Tur, Udad, Total pulses, Sesamum, Rapeseed, Castor, Fennel, Isabgul, Spices	Groundnut, Guar, Total oilseeds
<b>High</b>	-	Bajra, Gram, Cumin, Flowers	Cotton

were calculated and the crops were classified according to their positive and negative changes. The results are presented in Table 3.

The results revealed that rice and wheat which are the major food-grains showed positive change while bajra, maize and jowar which are the coarse grains showed negative change. It was further observed that the area under wheat was increased to more than double during the study period whereas area under bajra and jowar were reduced by 47.79 and 36.48 per cent, respectively. Overall, the total cereals showed positive change which showed 2.06 per cent rise during the study period.

All the pulse crops except gram showed the negative change. Area under gram was increased by 114.38per cent whereas area under tur, mung and udad were decreased by 33.17, 26.26, and 23.09 per cent, respectively. Overall, the total area under pulse crops was declined by 14.96 per cent during the study period. Like pulses, all oilseed crops except castor reported negative change. The acreage under castor increased to

double whereas acreage under groundnut, sesamum and rapeseed-mustard decreased by 22.60, 49.77, and 2.75 per cent, respectively. Further, it was worth to notice that soyabean which was newly introduced in Gujarat had reported considerable rise in its acreage. Overall, the area under total oilseed crops has decreased by 7.54 per cent during the study period.

Cotton is the major cash crop for Gujarat. It's area increased by 53.40per cent during the study period. The area under tobacco and guar seed were increased by 39.11per cent and 14.37per cent, respectively whereas area under sugarcane decreased by 19.61per cent. The acreage under horticultural crops showed positive changes during the study period. The area under fruits, vegetables, spices and flowers were increased by 25.99, 48.95, 18.63, and 111.5per cent, respectively with an overall rise of 31.38per cent. The results also revealed that gross cropped area of Gujarat state was considerably increased from 9426 thousand hectare to 11240 thousand hectare showing 19.24 per cent rise during study period.

**Table 3: Changes in Cropping Pattern in Gujarat State during the years 2001-02 to 2014-15**

(Area in '000 ha)

Crop	Positive Changes				Crop	Negative changes			
	First TE 2003-04	Last TE 2014-15	Actual change	Per cent change		First TE 2003-04	Last TE 2014-15	Actual change	Per cent change
<b>Cereals</b>									
Rice	667.3	758.4	91.0	13.64	Bajra	1119.4	584.5	-535.0	-47.79
Wheat	560.2	1211.8	651.7	116.33	Maize	493.1	433.6	-59.5	-12.07
Total Cereals	3100.8	3164.6	63.8	2.06	Jowar	202.4	128.5	-73.8	-36.48
<b>Pulses</b>									
Gram	84.6	181.4	96.8	114.38	Tur	325.3	217.4	-107.9	-33.17
					Mung	187.6	138.3	-49.3	-26.26
					Udad	110.0	84.6	-25.4	-23.09
					Total Pulses	786.9	669.2	-117.7	-14.96
<b>Oilseeds</b>									
Castor	347.3	697.6	350.3	100.85	Groundnut	1950.7	1509.8	-440.9	-22.60
Soyabean	NA	54.5	-	-	Sesamum	362.6	182.1	-180.4	-49.77
					Rapeseed &Mustard	233.0	226.6	-6.4	-2.75
					Total Oilseeds	2908.7	2689.5	-219.2	-7.54
<b>Cash Crops</b>									
Cotton	1683.9	2583.1	899.2	53.40	Sugarcane	231.6	186.2	-45.4	-19.61
Tobacco	102.3	142.3	40.0	39.11					
Guar	247.5	283.0	35.6	14.37					
<b>Horticultural Crops</b>									
Fruits	309.6	390.1	80.5	25.99					
Vegetables	386.0	575.0	189.0	48.95					
Spices	454.2	538.8	84.6	18.63					
Flowers	8.4	17.8	9.4	111.56					
Total	1158.3	1521.7	363.5	31.38					
Gross cropped	9425.7	11239.5	1813.8	19.24					

**Table 4: Region-wise crop diversification indices, temporal changes and their rank**

Region	Diversification Index	First TE 2003-04	Last TE 2012-13	Actual change	Percent change	Rank
North Gujarat	1-HI	0.8962	0.8941	-0.0021	-0.23	1
	EI	2.5612	2.4850	-0.0762	-2.98	
	MEI	0.8169	0.7925	-0.0243	-2.98	
	CEI	0.7813	0.7581	-0.0233	-2.98	
Middle Gujarat	1-HI	0.8878	0.8880	0.0003	0.03	2
	EI	2.4512	2.4657	0.0145	0.59	
	MEI	0.7818	0.7864	0.0046	0.59	
	CEI	0.7478	0.7522	0.0044	0.59	
South Gujarat	1-HI	0.8604	0.8730	0.0126	1.46	3
	EI	2.2109	2.3526	0.1417	6.41	
	MEI	0.7051	0.7503	0.0452	6.41	
	CEI	0.6745	0.7177	0.0432	6.41	
Saurashtra-Kutch	1-HI	0.7700	0.7813	0.0114	1.48	4
	EI	1.9499	1.9538	0.0040	0.20	
	MEI	0.6219	0.6231	0.0013	0.20	
	CEI	0.5948	0.5960	0.0012	0.20	
Gujarat State	1-HI	0.9028	0.8934	-0.0094	-1.04	-
	EI	2.6490	2.5922	-0.0568	-2.14	
	MEI	0.8448	0.8267	-0.0181	-2.14	
	CEI	0.8081	0.7908	-0.0173	-2.14	

HI = Herfindahl Index, EI = Entropy Index, MEI = Modified Entropy Index, CEI = Composite Entropy Index

### Crop Diversification:

To know the level of crop diversification, different Index was worked out. To know the regional changes, the whole Gujarat was divided into four regions *viz.*, Saurashtra, North, Middle and South Gujarat. The diversification indices for the first TE 2003-04 and the last TE 2012-13 and their temporal changes for all different regions as well as the State as a whole were worked out and the results are presented in Table 4.

The results revealed that the extent of diversification was found highest in North Gujarat as none of the crops was pre dominant in this region. Though it ranked first position, the extent of diversification was declined by about 3 per cent during the study period. The Composite Entropy Index (CEI) was 0.7813 and 0.7581 in the first and the last trienniums, respectively. Middle Gujarat occupied second rank with CEI 0.7478 and 0.7522 in the first and the last trienniums, respectively. It showed that the level of diversification was found stable, showing climactic adaptation in this region during the study period. South Gujarat with third rank reported 6.41 per cent rise in level of diversification. The CEI worked out to 0.6745 and 0.7177 in the first and the last triennium, respectively. Saurashtra-Kutch region reported the lowest diversification among all regions in Gujarat state. It was due to crops like cotton and groundnut were found very dominant over other crops. It was also noticed that the level of crop diversification remained stagnant during the study period. Overall, crop diversification in Gujarat state was moderately high with CEI 0.8081 and 0.7908 in first

and last trienniums, respectively, which secured farmers against climate risk. It showed that the level of crop diversification was slightly declined by 2.14 per cent during the study period.

### CONCLUSIONS

The acreage under major food-gains like wheat and rice, most of cash crops and all the horticultural crops were increased whereas acreage under all coarse cereals, pulses, oilseeds was declined, which was mainly due to increase in rainfall (in cotton growing area), irrigation facility, high prices and introduction of Bt cotton variety. High growth and low instability *i.e.* in case of major cereals, cash crops and horticultural crops shows risk security of farmers in terms of economic returns as well as in terms of climactic adaptation. Amongst the different regions, North Gujarat reported the highest level of crop diversification followed by Middle Gujarat, South Gujarat and Saurashtra-kutch. The pre dominant crop like cotton and groundnut in Saurashtra-kutch was responsible for low level of diversification in the region. Only South Gujarat region reported 6.41 per cent rise in level of crop diversification during the study period. Overall, Gujarat state reported a moderately high level of crop diversification but it was slightly declined during last decade, which secured farmers against climate risk.

### Policy Implications

Decline in area of coarse cereals as well as most of the pulses and oilseeds, emergence of cotton as an dominant crop during recent period, increased area and production of horticultural crops and low level of crop diversification

in Saurashtra-kutch region is a serious concern and needs suitable policy formulation in terms of export, processing and crop planning by the government to tap this new opportunity.

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## **An Economic Analysis of Silkworm Cocoon Production: A Case Study in Kolar District of Karnataka**

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### **ABSTRACT**

The present study is an attempt to assess the silkworm cocoon production and its profitability in five taluks of Kolar district of Karnataka through structured survey during 2012-13. The sample comprised of 120 families consisting of 440 members with an average of 4.40. The number of adult male and female members constituted 46.14 and 33.41 per cent respectively and the rest were children. The number of illiterates in the sample was to the tune of 33 per cent. Out of total acreage wetland constituted 27.36 per cent while garden land formed 14.53 percent and the land holding pattern indicated the predominance of marginal (47.5 per cent) and small farmers (30 per cent). The holding per family varied from 1.75 to 20.42 acres with an average of 4.13 acre. The total cost incurred for rearing of 8,000 DFLs per year was worked out to be ₹713640. Among the total cost, maximum cost was incurred towards the mulberry leaves ₹455000 (63.75per cent). The minimum cost of expenditure was incurred towards transportation and marketing ₹5000 (0.70per cent) and other costs were to the tune of ₹500 (0.07 per cent). The total net earnings from 10 batches per year was estimated to be ₹19, 13,000 per 8,000 DFLs per year with a benefit cost ratio of 1.59. The total investment on building and equipments for rearing of 8000 DFLs per year was worked out to be ₹30, 290. Among the depreciation cost incurred towards the equipments for rearing of 800 DFLs, the highest was contributed by mountages ₹25600 during the silkworm cocoon production activities.

### **Keyword**

Benefit-cost ratio, cost economics of cocoon production, disease free layings

### **JEL Codes**

C82, Q13, Q16

### **INTRODUCTION**

In India, about 90 per cent of the farmers are marginal and small land holders with fragmented agriculture holdings. The Indian farming system requires not only minimum investment oriented cropping but also assurance of self-employment for family labour in the light of existence of severe unemployment problems in rural areas. Mulberry sericulture is one of the income assuring occupations to rural folks. It needs low capital and ensures year round employment opportunities. The cocoon production consists of two major economic activities namely, cultivation of mulberry and rearing of silkworms. The establishment takes six months and garden maintenance has to be done round the year and the silkworm rearing activity for cocoon production is for one

month. Some studies were attempted to find out the economic prospects of sericulture in Karnataka, Andhra Pradesh, Tamil Nadu, West Bengal and Jammu & Kashmir (Meenal *et al.*, 2011; Lakshmanan *et al.*, 1996). The present study is attempted to investigate the economic profile and also its costs and returns.

### **METHODOLOGY**

The study was conducted in the traditional sericulture belt of Kolar District *i.e.*, Malur, Kolar, Srinivaspura, Bangarpet and Mulabagal Taluks during the year 2012-13. Multi-stage random sampling method was used for identification of 120 respondents, who are in to the cocoon production activity. The data were collected through personal contact with structured questionnaires. The data collected were analyzed by simple tabular

method, averages and percentages along with the frequencies were computed for working out the cost and returns of cocoon production (Munikrishnappa *et al.*, 2009; Hiriyanna *et al.*, 2002; Lakshmanan *et al.*, 2000; Lakshmanan & Geetha Devi, 2005; Srinivasa *et al.*, 2008; Balasaraswathi *et al.*, 2006, 2010).

## RESULTS AND DISCUSSION

### Age, Family Composition and Educational Status

The details of the family composition of the sample respondents, like age and educational status of the family are presented in Table 1. The sample comprised of 120 families, which had 440 members. Accordingly the average family size worked out to be 4.40. The number of children was 90 and constituted 20.45 per cent, while adult male and female members constituted 46.14 per cent and 33.41 per cent respectively. The average age of the head of the household was 49.22 years. The number of illiterates in the sample was to the tune of 33 per cent. Most literate members studied till higher secondary school with hardly six percent having attended college education.

**Table 1: Age, family composition and educational status of sericulture farmers**

Particulars	(N=120)
<b>Sample details</b>	
Average age of the Head of the family (Yrs.)	49.22
Family members (No.)	
Adult Male	203 (2.03)* (46.14)
Adult Female	147 (1.47)* (33.41)
Children	90 (0.90)* (20.45)
<b>Total</b>	<b>440 (4.40)*</b> <b>(100.00)</b>
<b>Educational status (Head of the household)</b>	
Illiterates	33 (33.00)
Primary school	22 (22.00)
Secondary school	17 (17.00)
High school	22 (22.00)
College	6 (6.00)
Number of literates (b to e)	67 (67.00)
<b>Total</b>	<b>100</b> <b>(100.00)</b>

Figures in parentheses indicate percentages to the total.

\* Denotes per household (within the parenthesis)

### Land holding Pattern

The selected village being located in the Eastern Dry Zone of the state, dry land/ rainfed agriculture dominated occupying 56.11 per cent of the total area (Table 2). Wetland constituted 27.36 per cent while garden land formed 14.53 percent of the total area among the sample farmers. The land holding pattern (Table 2) indicated the predominance of marginal (47.5 per cent) and small farmers (30 per cent). The average holding size of the sample farmers was 4.13 acres in the study village. The sample consisted of 16.25 percent of farmers owning 5-10 acres of land and 6.25 percent of large farmers having more than 10 acres of land. In terms of area, about 46 percent of the total area in the study village is cultivated by the marginal and small farmers while 22.94 percent of the total area is cultivated by medium farmers. Large farmers accounted for 30.94 percent of the total cultivated area.

**Table 2: Land holding pattern in silk cocoon producers (In acres)**

Category of land	Total	Per household
Dry Land	185.17 (56.11)	2.31
Wet Land	90.28 (27.36)	1.13
Garden land	47.95 (14.53)	0.60
Fallow	6.61 (2)	0.08
<b>Total</b>	<b>330.01 (100)</b>	<b>4.13</b>

### Cost and Returns of Cocoon Production

The total cost incurred for rearing of larvae out of 8,000 DFLs per year from III<sup>rd</sup> instar onwards 8,000 DFLs per year was worked out to be ₹713640. Among the total cost, maximum cost was incurred towards the mulberry leaves ₹4,55,000 (63.75per cent) followed by cost of 8,000 DFLs chawki worms ₹96,000 (13.45 per cent), labour ₹1,00,000 (14per cent), depreciation on building and equipments ₹30,290 (4.24 per cent), gunny cloth, old newspapers, paraffin papers ₹6,250 (0.87 per cent) and disinfectants ₹20,600 (2.86 per cent). The minimum cost of expenditure was incurred towards transportation and marketing ₹5,000 (0.7 per cent) and other costs ₹500 (0.07 per cent) (Table 3)

The returns realized through sale of 5,600 kg of cocoons @ 70 kg per 100 DFLs and @ ₹340 per kg was ₹19,04,000. Small portion, ₹9,000 of returns was also realized through sale of by products. The total net earnings from 10 batches per year was estimated to be ₹19,13,000 per 8,000 DFLs per year; thus earning a income of ₹1.59 for every rupee of expenditure. The net return earned was estimated to be ₹1, 19,936 per batch of 800 DFLs per hectare (Table 3). Kerutagi (1996) also reported the similar trend of cost and returns per ha per year. The cost of mulberry leaves found by them was the highest (₹14,435; 40 per cent) followed by human labour (₹7,100; 20 per cent) for the total cost.

**Table 3: Cost and returns of cocoon production per 8,000 DFLs per year**

Sl. No	Particulars	Quantity	Unit price	Amount	Per cent share
<b>A. Variable costs</b>					
1	Leaf (65,000 kg / ha)	65,000	7	455000	63.75
2	800 DFLs chawki worms @ ₹ 1200 / 100 DFLs	8,000	12	96000	13.45
3	Gunny cloth, old news papers, paraffin paper, etc. (₹)	-	-	6,250	0.87
<b>Sub total</b>					<b>78.07</b>
4	<b>Disinfectants</b>				
	i. Sanitech/Chlorine dioxide (lit.)	50	100	5000	0.70
	ii. Lime powder (kg)	240	10	2400	0.33
	iii. Vijetha (kg) @ 30 kg/100 DFLs	240	55	13200	1.84
<b>B Sub total</b>					<b>2.87</b>
5	Labour (MDs)*	500	100	50,000	7.00
7	Labour (MDs)**	250	200	50,000	7.00
8	Transportation and marketing expenses (₹)	-	-	5,000	0.70
9	Miscellaneous	-	-	500	0.07
10	Depreciation on building & equipments	-	-	30290	4.24
<b>Sub total</b>					<b>21.91</b>
<b>Total</b>				<b>713640</b>	<b>100.0</b>
<b>C. Returns</b>					
1	Sale of cocoons (kg)	5,600	340	19,04,000	99.52
2	Income from by products	-	-	9,000	0.48
<b>Total</b>				<b>19,13,000</b>	<b>100.0</b>
1	Net return (C-(A+B))	-	-	11,99,360	-
2	Return per rupee of expenditure (₹)	-	-	<b>1.59</b>	-

\*Man days (women); \*\*Man days (men)

**Table 4: Investment on building and equipments for rearing of 8000 DFLs per year**

Sl. No.	Particulars	Quantity	Unit price	Amount	Life span	Depreciation	Per cent share
<b>I. Cost</b>							
<b>A Building</b>							
1	Late age rearing house including chawki and shoot store room (70" x 23") 1610 sq. ft.	1,610	250	4,02,500	50	8,040	12.66
2	Varanda (30" x 23") 690 sq. ft.	690	250	1,72,500	50	3,450	5.43
<b>Sub-Total</b>						<b>11,490</b>	<b>18.09</b>
<b>B. Equipments (minimum required)</b>							
1	Sprayer (No.)	1	8,000	8,000	10	798	1.25
2	Room heater (No.)	4	1,000	4,000	5	798	1.25
3	Humidifier (No.)	4	3,000	12,000	5	2,400	3.78
4	Burner (No.)	4	300	1,200	5	240	0.37
5	Deflossing machine (No.)	2	1,550	3,100	5	618	0.97
6	Cocoon harvester (No.)	4	300	1,200	5	240	0.37
<b>Sub-Total</b>				<b>29,500</b>		<b>5,094</b>	<b>7.99</b>

**Investment on Building and Equipments**

The total investment made on building and equipments for rearing of 8000 DFLs per year was ₹30,290, of which ₹11,490, ₹5,094, and ₹30,290 (Table

4.) was required towards building, minimum equipments and equipments for rearing varying capacities, respectively. Among the equipments, highest cost was incurred towards humidifier ₹2,400 followed by sprayer

₹798, room heater ₹798, mountage deflashing machine ₹618, burner ₹240 and cocoon harvester ₹240. The equipments minimum required constituents about 7.99 per cent of per unit of total investment (Table 4).

Among the depreciation cost incurred towards the equipments required for rearing of 8000 DFLs larvae, the highest was contributed by mountages ₹25,600 followed by shoot rearing rack ₹3600, nylon nets ₹640, leaf chamber ₹300, litter basket or vinyl sheets ₹252, plastic basins ₹198 and plastic buckets ₹198 (Table 4).

#### CONCLUSIONS

The present study is embarked upon Kolar district of Karnataka with the focus on socio-economic background, income- generation, cropping pattern and operational problem of the sericulturists selected for the study. Sericulture is an income- generating industry. It plays a crucial role in transferring wealth from richer to the poorer. The study draws the following implications for the perspective development of sericulture in long run in the study regions. The study indicates that sericulture has a good potential to generate attractive income for the farmers. The cost and returns important aspects in Indian sericulture industry impact on growth and development of mulberry cocoon producers among this activity maximum per rupee of expenditure in cocoon production, this was due to highest cocoon price fetched at this movement. It is more labour intensive and has low capital requirement and serve a good option for small farmers to gain meaningful employment and income throughout the year.

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## **An Analysis of Prospects and Problems of Greenhouse Gerbera Cultivation in South Gujarat<sup>#</sup>**

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### **ABSTRACT**

*Greenhouse agriculture allows consistent supply of high quality produce, a critical need of most markets. Present study was one of its first kinds of systematic effort in the region to study the current marketing practices and suggest the policy efforts in the direction for improved marketing of greenhouse crops. The study identified that in south Gujarat, Gerbera is major green house crop in the region. Gerbera cut flower cultivation results in net returns of ₹8, 86,168 per acre and benefit - cost ratio was estimated to be 1.48. The break even volume is estimated to be 12, 51,204 number of flowers which can be achieved in second year. This suggests that gerbera cultivation in green house provides good income although the cost of production and marketing is also high. Major constraints in green house farming by green house growers were identified as low price of produce, high initial investment, distant markets, problem of pest and diseases, fluctuation in market prices, etc.*

### **Keywords**

Gerbera, green house, marketing, production

### **JEL Codes**

C81, O13, Q13

### **INTRODUCTION**

Greenhouse horticulture allows consistent supply of high quality produce, a critical need of most markets. Market arrangements vary in factors such as produce chain requirements, payment time and duration of access. Despite the market potential for these crops, it is therefore essential that each potential grower identifies a market before undertaking production (Anonymous, 2011). A comprehensive marketing policy must be implemented in order to reduce the transportation costs, supply the produce in the market as per the demand and stabilize their prices. Present study was one of its first kind of systematic effort in the region to study the economics and marketing of greenhouse cultivation in the direction for improved marketing of greenhouse crops. The study was conducted with the below mentioned objectives:

- i. to assess the present status of Greenhouse cultivation and marketing in South Gujarat,

- ii. to estimate costs and returns for Gerbera production in greenhouse, and
- iii. to identify the main constraints influencing production and marketing of greenhouse crops in South Gujarat.

### **METHODOLOGY**

The study was conducted in South Gujarat region of India. Five districts namely Bharuch, Surat, Navsari, Tapi and Valsad were purposively selected for the study. Primary data was collected by personal interviews of different greenhouse growers. Data was collected using survey method by conducting personal interviews with greenhouse growers of Gujarat. Pre tested questionnaires were used for collection of primary data from green house growers for the study.

Secondary data was collected through various sources like Government websites of NHM, NHB, Gujarat Government, SHM, etc., magazines, internet sources, green house construction company leaflet and other

<sup>#</sup> *Authors are highly grateful to Gujarat Horticulture Mission, Gandhinagar and Directorate of Research at Navsari Agricultural University and Dean, ASPEE Agribusiness Management Institute for providing all the*

sources. Various reports and article from the internet provided the information regarding greenhouse, different crops under greenhouse, production, and productivity. Data was also collected from horticulture department of each districts of South Gujarat region.

Farmers were selected purposively based on the area under green house and crops selected for cultivation. For selecting farmers, Horticulture officers' opinion was also taken to identify progressive greenhouse growers from various talukas in the district. Total 31 greenhouse growers were surveyed from the five selected districts. Data was analyzed using simple tools of analysis such as averages, percentages and weighted average method.

## RESULTS AND DISCUSSION

### Present Status, Size and Structure of Greenhouse Operations

The perusal of Table 1 below has been prepared by taking various reports of greenhouses assisted by NHB, NHM and RKVY under various schemes for various years to prepare an estimate of total approximate area under green houses in the region. Largest number and area of green houses are in Surat and Navsari districts. There was more number of greenhouses of size 2000 to 4000 sqm followed by greenhouses of size of 1000 to 2000 sqm. As shown in Table1, approximately 95.88 ha area is

under greenhouse cultivation in South Gujarat region. The perusal of Table 2 shows the size of greenhouse as per the respondents. Total 31 green house growers surveyed were having total 61 green houses. Majority (59per cent) of these green houses were of 3000-4000 square meter size. Only 8.2per cent green houses were of size greater than 4000<sup>2</sup>metre.Only 4.9 per cent green houses were below 1000 square meter size. The size of greenhouse selected depends upon the grower's ability to invest and also because of the subsidy available for maximum 4000<sup>2</sup>metre for one grower.

### Selling Parameters for Consumers

The perusal of Table 3 shows the different crops grown under greenhouse, Average area under green house and average yield per acre in green house. Majority (37.5 per cent) of greenhouse growers were producing Gerbera followed by Cucumber (17.5 per cent), Capsicum (12.5 per cent), Dutch Rose (7.5 per cent), Nursery (7.5per cent), Yam (7.5 per cent), Ginger (5 per cent) and Tomato (5 per cent). Gerbera is major greenhouse crop in the region. According to the information given by these growers as shown in table 3 below, average yield of Gerbera was 11 lakh flowers annually in an average area of 4040 m<sup>2</sup>. The average yield of Dutch Rose was 15 lakh flowers in 4000<sup>2</sup>metre area. The average yield of

**Table 1: Estimated number of greenhouse operations by size in south GUJARAT by regions**

District	Area	Number by size of operation				Total (No.)
		≤ 1000	1 000 to 2 000	2 000 to 4 000	>4 000	
Bharuch	64071.2	0	1	21	0	22
Narmada	14000	2	-	3	0	5
Surat	543312	0	14	141	0	155
Tapi	127040	0	4	18	6	28
Navsari	130311	4	48	2	11	65
Valsad	80164	1	14	16	0	31
<b>Total</b>	<b>958898.2</b>	<b>7</b>	<b>81</b>	<b>201</b>	<b>17</b>	<b>306</b>

Source: Horticulture Department and as compiled from various reports of NHM,NHB, etc

**Table 2: Distribution of greenhouse growers by size of green house**

Size	Number	Percentage
> 4000	5	8.2
3000-4000	36	59.0
2000-3000	10	16.4
1000-2000	7	11.5
< 1000	3	4.9
<b>Total</b>	<b>61</b>	<b>100.0</b>

**Table 3: Distribution of greenhouse growers by crop, average area and yield obtained**

Crops	No.	Percentage (per cent)	Average area (m <sup>2</sup> )	Average yield/acre
Gerbera	15	37.5	4040	1100000
Dutch rose	3	7.5	4000	1500000
Capsicum*	5	12.5	4000	45
Ginger*	2	5.0	4000	6.5
Yam*	3	7.5	3533	5.6
Tomato	2	5.0	1500	-
Cucumber*	7	17.5	2150	5.2
Nursery	3	7.5	1800	-
<b>Total</b>	<b>40</b>	<b>100</b>		

\*Yield in tonnes per acre

Capsicum, Ginger, Yam and Cucumber were 45, 6.5, 5.6, and 5.2 tonnes in an average area of 4000, 4000, 3533, and 2150 m<sup>2</sup>, respectively.

The perusal of Table 4 clearly shows the major selling parameters considered by consumers according to greenhouse growers. Majority of the respondents said that Quality (80) is the most important factor affecting the sale of flowers and vegetables grown in greenhouses. (Chaudhary, 2011). They should be fresh, free of disease and good in appearance when they reach market. Time of Purchase (71) is one of the most important factors as sale of flowers is mostly influenced by occasions and festivals. Price (65) of the produce in market is again very important particularly for growers as they want to sell in those markets where they get good price. Availability (42), Variety (35), Organic (34) and Services (33) were considered less important.

#### Cost and Returns of Gerbera Production under Greenhouse

Economic analysis of such capital intensive technique is immensely important. Economic analysis of production and marketing of Gerbera grown under greenhouses in South Gujarat region was carried out. The cost of construction of polyhouse depends upon the area, quality and quantity of material such as steel, shedding net, basic infrastructure etc. Since most of the polyhouses were naturally ventilated type, the estimated cost of erection of these polyhouses was estimated.

The cost of production of selected cut flowers Gerbera

in 4000 m<sup>2</sup>. (1 acre) size green house was estimated and depicted as mentioned below-

The perusal of Table 5 shows the establishment cost per acre of Gerbera. It includes green house structure, planting material cost, irrigation system, bed preparation and land development, etc. It can be observed that major item of establishment cost is cost of greenhouse structure and cost of planting material, which was 56.96 and 16.43 per cent respectively. The total cost of establishment of a greenhouse was estimated to be 45.65 lakhs. Net cost was estimated to be 15.98 lakhs after deducting subsidy at the rate of 65 per cent of the construction cost.

Cost of cultivation under greenhouse condition includes all the cost incurred annually for the maintenance cost was divided into variable and fixed costs. The perusal of Table 6 shows the cost of production per acre of Gerbera. The total average cost of production for 1 acre sized greenhouse of Gerbera was estimated to be ₹18, 63,832. The cost of interest on capital at the rate of 12 per cent per annum (10.29 per cent), amortized establishment cost (10.72 per cent) and depreciation (6.82 per cent) were the main elements of fixed cost. Amortized establishment cost was calculated for the period of one year considering the average life of structure as 10 years and average life of plastic film and planting material for five years for gerbera.

The major elements of variable cost were cost of Freight and commission (14.75 per cent) each, cost of packaging (11.8 per cent), fertilizers (9.66 per cent),

**Table 4: Major selling parameters considered by market according to greenhouse growers**

Factors	High (3)		Medium (2)		Low (1)		Total	
	No.	Score	No.	Score	No.	Score	No.	Score
Quality	20	60	9	18	2	2	31	80
Time of purchase	15	45	10	20	6	6	31	71
Price	12	36	10	20	9	9	31	65
Availability	4	12	3	6	24	24	31	42
Variety	0	0	4	8	27	27	31	35
Organic	1	3	1	2	29	29	31	34
Services	0	0	2	4	29	29	31	33

**Table 5: Per acre establishment cost of gerbera**

Per acre establishment cost of Gerbera		
Particulars	Cost (₹Lakhs)	Percentage to total
1. Land development: Leveling & fencing	2.25	4.93
2. Greenhouse structure (Galvanized pipe, poly film)	26.00	56.96
3. Grading/packing room, labour and store room, farm equipments	1.90	4.16
4. Irrigation system (Drip irrigation, fogger)	4.00	8.76
5. Planting material cost	7.50	16.43
6. Bed preparation cost	4.00	8.76
Total cost	45.65	100
Net cost with subsidy @ 65per cent	15.98	

**Table 6: Per acre cost of production of Gerbera**

Per acre cost of Production of Gerbera		
Particulars	Cost	Percentage
<b>A. Fixed costs</b>		
Interest on capital @ 12 per cent per annum	191730	10.29
Amortized establishment cost (75 per cent for 10 years and 25per cent for 5 Years)	199719	10.72
Depreciation	127050	6.82
<b>Total fixed costs (A)</b>	<b>518499</b>	<b>27.82</b>
<b>B. Variable costs</b>		
a. Fertilizers	180120	9.66
b. Pesticides	186000	9.98
c. Electricity charges @25per cent subsidy	18000	0.97
d. Labour Cost 1440 man days	158400	8.50
e. Grading/packaging cost ₹0.20/flower	220000	11.80
f. Freight charges @ ₹0.25 / flower	275000	14.75
g. Commission charges @10 per cent	275000	14.75
h. Interest on working capital @ 10 per cent	32813	1.76
<b>Total variable costs (B)</b>	<b>1345333</b>	<b>72.18</b>
<b>Total annual costs (A+B)</b>	<b>1863832</b>	<b>100</b>

pesticides (9.98per cent), and labor (8.5per cent) of total cost. The share of fixed cost “A” and variable cost “B” was estimated to be 27.82 and 72.18 per cent in the total cost of production respectively.

In case of gerbera, the average prices received during the monsoon season were the lowest, while in marriage and festivity seasons they were the highest. According to growers, they received an average price of ₹2.50 per flower.

The perusal of Table 7 shows yield, cost, and returns per acre from Gerbera. The average yield of gerbera was 11 lakh flowers per acre. The gross returns from the cultivation of Gerbera cut flowers were estimated to be ₹2750000 at the rate of average ₹2.50 per flower. The total production cost was estimated as ₹1863832. Gerbera cut flower cultivation results in net returns of ₹886168 per acre. The corresponding benefit-cost ratio was estimated to be 1.48. The break-even volume is estimated to be 12,51,204 number of flowers. Farmers start getting profit from second year. From this, it is clear that gerbera cultivation in green house provides good income although the cost of production and marketing is also high.(Majumdar & Lahiri,2012). It depends upon getting good yield in Gerbera production. It is important to adopt regular crop management practices for regular and good yield as profits totally depend upon good yield of produce.

**Table 7: Per acre yield and return from gerbera**

Particulars	Cost (₹ lakhs)
Yield output (No.) (average 45 flowers/plant)	1100000
Price per flower	2.50
Gross returns	2750000
Total annual cost	1863832
Net returns	886168
Breakeven point (volume)	1251204
B:C ratio	1.48

Farmers can get higher prices in markets for Gerbera grown under protected cultivation because of higher bud size, shining, stalk length, good colour and better quality as expressed by the respondents. However reducing and stagnant prices of Gerbera in market is a cause of concern for farmers in recent year.

**Major problems experienced by greenhouse producers in South Gujarat.**

Overall major constraints in green house farming were identified and depicted in Table 8. Among all these constraints the highest ranked constraint is low price of produce (64.5 per cent). Majority (64.5 per cent) respondents reported the problem of low prices of produce in the market. Especially gerbera growers reported reducing prices of gerbera flowers as compared to earlier years while cost of inputs such as pesticides, fertilizer, packaging and labour has increased. Among the economic constraints, majority respondents(58.06per cent) said the High initial investment in green house farming is a major problem .The cost of establishment is high even after subsidy given by government and therefore restricts new farmers for entry as well as existing from expanding the area. This cost affects the cost of operations too and therefore increases the need for good returns in order to cover the

**Table 8: Major constraints (overall) experienced by greenhouse growers**

Constraints pinioned	Number	Percentage	Rank
Low prices of produce	20	64.5	I
High initial investment	18	58.0	II
Distant market	17	54.8	III
Problem of pest and diseases	16	51.6	IV
Fluctuation in market prices	16	51.6	IV
Takes lots of time & attention	16	51.6	IV
High cost of pesticides/fertilizers	15	48.4	V
Lack of market information	14	45.2	VI
High cost of planting/seed material	11	35.5	VII

high investment. (Mayanglambam & Thakur, 2013). 54.8 per cent growers reported distant market as a major problem. Lack of local market for flowers and vegetables such as capsicum have increases dependence on distant markets such as Delhi, Mumbai, Bangalore, Jaipur, etc. It also increases cost of transportation. Among the production constraints, problem of pest and diseases (51.6 per cent) was also reported as a major problem. Fluctuation in market prices (51.6 per cent), takes lot of time and attention (51.6 per cent), high cost of fertilizers and pesticides (48.4 per cent), lack of market information (45.2 per cent) and high cost of planting material (35.5 per cent) were other major constraints faced by greenhouse growers.

### SUGGESTIONS

- 1 Crop wise collection centres should be established for grading, packing and sorting with cold storage facilities for the produce at a few centres so as to facilitate marketing of greenhouse crops. Such collection centers should work for establishing market linkages in various markets to get the best price. These can be utilized for developing a channel for organized retail segment as well as export. These collection centres can be established under Private ownership / cooperative form or even as Producer Company with assistance of Government/NHM.
- 2 Collective marketing approach should be utilized for accessing new markets, sharing risks, gaining better price and reduce costs by new as well as existing farmers. Government should initiate some interventions for group marketing for greenhouse crops. Co-operative marketing or cluster approach is important for such high investment crops and fluctuating market for risk sharing (Muthukumar, 2010).
- 3 Government Horticulture department and university should try to introduce new crops for diversification in green house farming in the area. Diversification can bring change in farmer's economic situation.
- 4 There should be a proper system of market information dissemination about prices of these greenhouse crops as mostly the information of prices and arrivals of these crops such as rose, gerbera, capsicum is not available on *agmarknet*, it is available at NHB website but most of the farmers are unaware as well as this information is also incomplete and often not reported timely

### CONCLUSIONS

In south Gujarat, largest number and area of green houses are in Surat and Navsari districts. More number of greenhouses is of size 2000 to 4000<sup>2</sup>metres followed by

greenhouses of size of 1000 to 2000<sup>2</sup> metre. Majority (37.5 per cent) of greenhouse growers were producing Gerbera followed by Cucumber (17.5 per cent), Capsicum (12.5 per cent), Dutch Rose (7.5 per cent), Nursery (7.5 per cent), Yam (7.5 per cent), Ginger (5 per cent) and Tomato (5 per cent). Gerbera is major greenhouse crop in the region. The major factors that improve marketing of produce and better income as perceived by greenhouse growers was Product (16.9 per cent) growers said as it is the produce which creates demand in market so the production of right variety, colour and size is important.

The average yield of gerbera was 11 lakh flowers per acre. The gross returns from the cultivation of Gerbera cut flowers were estimated to be ₹27, 50,000 at the rate of average ₹2.50 per flower. The total production cost was estimated as ₹18, 63,832. Gerbera cut flower cultivation results in net returns of ₹8, 86,168 per acre. The corresponding benefit - cost ratio was estimated to be 1.48. The break-even volume is estimated to be 12, 51,204 number of flowers. Farmers start getting profit from second year. From this, it is clear that gerbera cultivation in green house provides good income although the cost of production and marketing is also high. It depends upon getting good yield in Gerbera production.

Major constraints in green house farming by greenhouse growers were identified as low price of produce (64.5 per cent) followed by High initial investment (58.0 per cent), distant markets (54.8 per cent), problem of pest and diseases (51.6 per cent), fluctuation in market prices (51.6 per cent), takes lot of time and attention (51.6 per cent), high cost of fertilizers and pesticides (48.4 per cent), lack of market information (45.2 per cent) and high cost of planting material (35.5 per cent), respectively.

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## **Socio Economic Analysis and Marketing Channels of Fish Farmers in Nalgonda District of Telangana State**

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### **ABSTRACT**

*The present study is taken up with the objective of knowing the socio economic characteristics of paddy farmers who take up fish farming in Nalgonda district which is the largest producer of inland fish and prawns over the past few years. The study also identified the marketing channels of the fish and prawn market, constraints faced by the farmers also suggested that if the farmers were given the right training in the areas they are lacking and if the importance value addition in fish is explained to them providing the logistic support, the fishery sector will be the fastest growing sector in Bangaru Telangana.*

### **Keywords**

Fisheries, marketing channels, Nalgonda, paddy, Telangana state

### **JEL Codes**

M31, Q13, Q22

### **INTRODUCTION**

Fishery is the oldest and most important livelihood option for the inhabitants of the coastal line of the country since times immemorial. This natural resource along with the marine environment has not only been the custodian of livelihood security of the coastal populace but also supports the productive and protective habitats. The web of life of the coastal community is woven around it, be it festivals, weddings or even death, the community is intricately related to the natural marine resource. This gift of nature is wedded to the customs and traditions of the coastal society, which understands that this vast natural resource is the key to their prosperity and social development.

Production of aquatic animals from aquaculture in 2014 amounted to 73.8 million tonnes, with an estimated first-sale value of US\$160.2 billion. This total comprised 49.8 million tonnes of finfish (US\$99.2 billion), 16.1 million tonnes of molluscs (US\$19 billion), 6.9 million tonnes of crustaceans (US\$36.2 billion) and 7.3 million tonnes of other aquatic animals including amphibians (US\$3.7 billion). China accounted for 45.5 million tonnes in 2014 or more than 60 percent of global fish production from aquaculture. Other major producers were India, Viet Nam, Bangladesh and Egypt. (FAO, 2016)

Approximate of about 1 per cent of the total population depends upon fishery sector in India as a primary source of livelihood - direct employment to about 6 million fishers and to another six million people who are employed in fishery related activities. The contribution of fisheries to Gross Domestic Product (GDP) at the current price level is 1.3 per cent. India has an estimated marine resources potential of about 3.9 million tonnes per year. This potential source can be bracketed under two categories i.e. oceanic fishery and coastal fishery.

The important marine fish disposition in India are the Mackerel, Sardines, Bombay duck, Shark, Ray, Perch, Croaker, Carangid, Sole, Ribbonfish, Whitebait, Tuna, Silver belly, Prawn, Shrimp, Squid, Octopus, Red snapper, Lobster, Cat fish and Cuttlefish. Among the species caught, Indian oil sardine, Indian mackerel and Sciaenidae are dominant ones. Marine shrimp, although contributing only 10 per cent of the total catch, is still of paramount commercial importance.

The main freshwater fish are carp and catfish; the main brackish-water fish are hilsa (a variety of shad), and mullet.

Nearly 70 per cent of the fish catch is marketed fresh. The fish drying and curing industry amounts to about 14 per cent fish. Frozen fish production accounts for 6.5 and

8.4 per cent goes for reduction to fish meal, 0.8 per cent for offal reduction and 1.6 per cent for miscellaneous purposes. Only 0.3 per cent of the total catch is used for canning purposes. The per capita fish availability in India is 4.7 kg/year (Laurenti, 2002).

#### Andhra Pradesh Scenario – Fish Production

The Government of Andhra Pradesh has identified the Fisheries sector as a Growth Engine for social economic development of the new State of Andhra Pradesh. The Vision 2029 Programme promotes the rational exploitation and utilization of the State's fishery resources in a manner consistent with the overall goal of sustainable development. Andhra Pradesh has fertile river basins, extensive canal system and conducive agro climatic conditions for fishery promotion.

Telangana was separated from Andhra Pradesh as a new 29th state of India. The state is bordered by the states of Maharashtra, Chattisgarh to the North, Karnataka to the west, and Andhra Pradesh to the south, east and north east.

Fisheries sector is one of the fast growing sectors in Telangana providing cheap and nutritious food and source of livelihood for a large section of economically backward population of the state. The production of inland fish and prawn during the year 2013-14 is 249633 MTs, in terms of value it is Rs. 247987 lakhs and its contribution is 0.6 per cent in GSDP. Production of inland fish, including prawns is given in the following chart.

#### METHODOLOGY

The present study was carried out in Andhra Pradesh with special emphasis in Wadaparthi and Pendlipaakala villages of Nalgonda district. The specific objectives were to obtain the socio economic parameters of sample farmers, identifying the bottlenecks so that the district in Telangana can contribute its share in for this Nalgonda district is purposively selected as the production is highest among all other districts in Telanagana state. Bhongir and Devarakondamandals are selected. Two villages namely Wadaparthi in Bhongir Mandal and Pendlipakala in Devarakonda Mandal were selected. In these villages the paddy growers are identified, among them sample farmers from the identified. *Pendlipakala Project* Ayacut in ha.1618.78 and Pendlipakala 505 ha tank area is selected by following simple random technique. The required primary data is obtained from 20 sample farmers from each village by interview method. Farmers from a

**Table 2: Inland fish and prawns production, 2010-11 to 2013-14**

District	2010-11	2011-12	2012-13	2013-14
Mahabubnagar	27,385	29,164	31,425	35,166
Rangareddy	6,098	5,934	5,827	8,157
Hyderabad	5	12	20	12
Medak	9,165	20,133	16,669	23,771
Nizamabad	19,179	21,810	23,670	26,695
Adilabad	7,525	18,361	23,741	30,533
Karimnagar	10,182	4,099	27,048	22,756
Warangal	14,666	22,233	22,687	30,188
Khammam	13,650	23,770	35,016	37,240
Nalgonda	27,939	34,966	33,525	35,115
Total	1,35,794	2,00,482	2,19,628	2,49,633

range of 2 acres to 20 acres of land holding were interviewed who grow paddy as a part in their land holding

#### RESULTS AND DISCUSSION

It is observed from the values that about 95 percent of the respondents (19 out of 20 respondents) have primary occupation as fisheries and secondary occupation as agriculture. Only 1 respondent out of 20 respondents have agriculture as primary occupation and fisheries as secondary occupation. One of the respondents possesses business as primary occupation and fisheries as secondary occupation.

**Land Particulars:** land particulars of the respondents were studied and presented in the Table 4 and the crops grown in the land was shown on Table 5. Command area and outside command area were studied that the respondents comprise head, middle and tail kinds of command area. The respondents possess an average of 2.83 acres of area for head type of command area, 2.21 acres of area for middle type of command area and 2.63 acres of outside command area. Only 3 respondents have of head type of command area about 8.5 acres of which 2 respondents grow fishing, 1 person grows paddy and

**Table 3: Occupational details of respondents**

(N=20)			
Primary Occupation		Secondary Occupation	
Fisheries	Agriculture	Agriculture	Fisheries
95.00	5.00	95.00	5.00

**Table 1: Top five fish producing States in order during 2011-12 to 2014-15**

Year	(Production in '000 tonnes)				
	Andhra Pradesh	West Bengal	Gujarat	Kerala	Tamil Nadu
2011-12	1603.17	1472.04	783.72	693.21	611.49
2012-13	1675.44	1490.01	848.79	677.78	620.40
2013-14	2018.42	1580.65	793.42	708.65	624.30
2014-15	1964.43	1617.319	809.93	632.256	697.61

Source: Department of Animal Husbandry, Dairying & Fisheries, Government of AP

**Table 4: Land Particulars of respondents**

Land particulars		(Acres)	
		Average area	Total area
Command area	Head	2.83	8.5
	Middle	2.21	28.75
	Tail	-	-
Outside command		2.63	50

cotton alternatively. 13 respondents have middle type of command area about 28.75 acres of which all the 13 respondents grow fishing and 2 respondents also grow paddy alternatively. About 19 respondents have outside command area of 50 acres of which 4 respondents grow cotton and paddy in 12 acres, 1 person grow cotton and millets in 1 acre, 8 persons grow only cotton in 15 acres and 4 persons grow paddy in 8.5 acres. 4 respondents grow cotton, paddy alternatively and 1 respondent grow only cotton.

**Fishing Assets:** In order to perform fishing, the respondents have certain fishing assets such as fishing nets, fishing boats, ice box and other materials. The numbers of these fishing assets with respondents were shown in the Table 5. Fishing nets on an average number of 8 are present with 19 respondents where total number of nets present with them was 149. With 18 respondents, 20 fishing boats were present where on an average about 1 fishing boat is present with an individual. 19 ice boxes are present with 18 respondents indicating 1 ice box on average with each respondent. 4 respondents have other 4 number of assets with an average of 1 asset with individual (Table 6).

**Details of own fishing activity:** It was noticed that the respondents were found to be involved in the fishing activities such as catching and rearing of fish (Table 7). In the case of catching fish, 19 respondents' harvested fish on an average quantity of 14, which on totality about 265 is harvested. The respondents consumed quantity of 2 on average and on total 4 by 2 respondents. The respondents sold about quantity of 15 on average such that 18 respondents combined sold quantity of 269. The price received by selling the fish is Rs. 1005 per kg by 19 respondents which is on average Rs.53 per kg.

**Table 5: Location of respondents in the command area and crops grown**

Head area of canal of command area (3 respondents)					
Fishing		Paddy		Cotton	
2 (6.5)		1 (2)		1 (2)	
Middle reach of command area (13 respondents)					
Fishing		Paddy			
13 (28.75)		2 (12)			
Outside command area (19 respondents)					
Cotton and Paddy		Cotton and Millets		Cotton	Paddy
4 (12)		1 (1)		8 (15)	4 (8.5)
				3 (9.5)	2 (3.5)

Figures in parentheses were area covered by respondents in acres

**Table 6: Number of fishing assets with respondents**

Assets	Average number	Total number
Fishing nets	8	149
Fishing boat	1	20
Ice box	1	19
Other	1	4

**Table 7: Details of fishing activity as an individual**

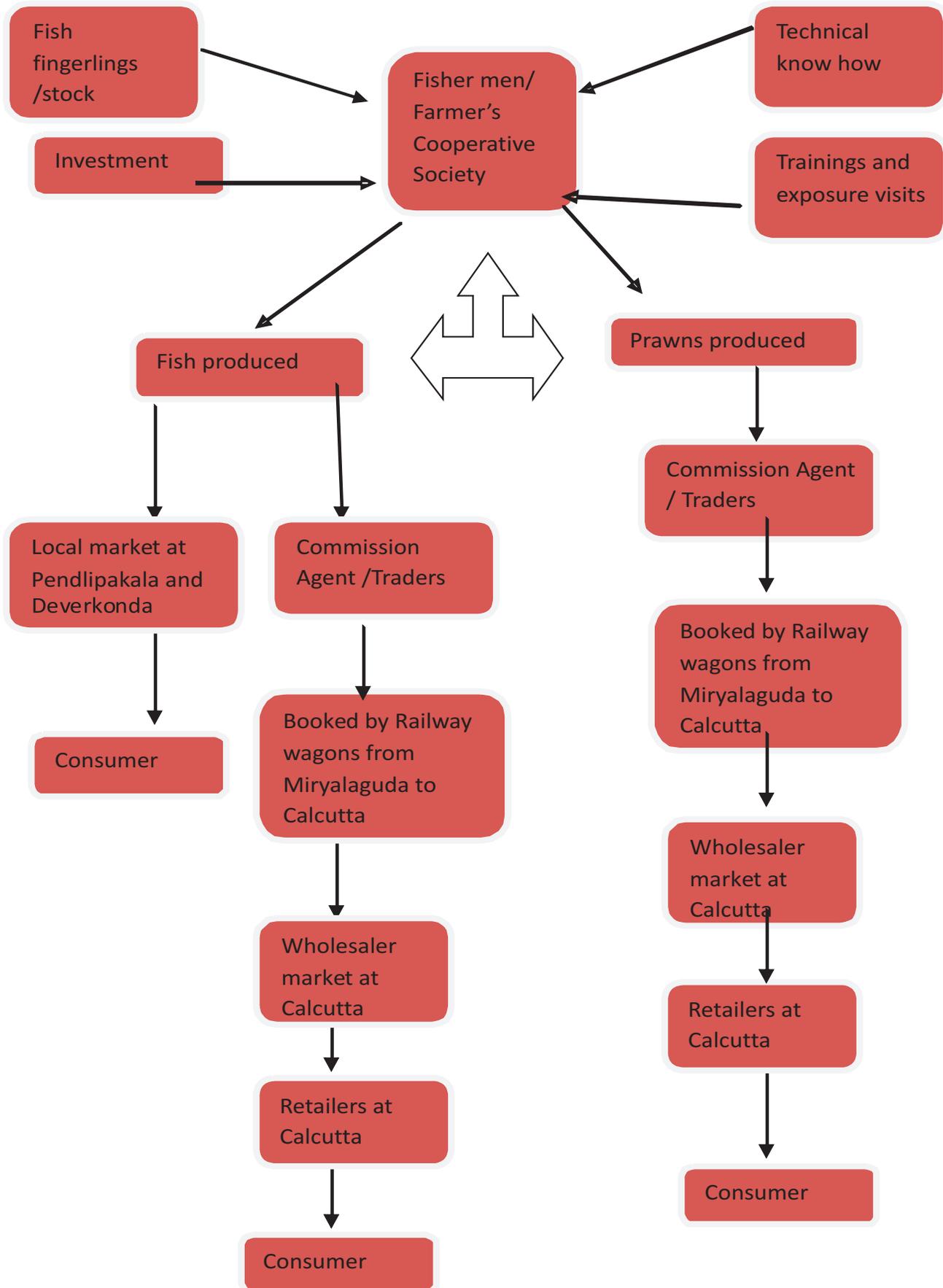
(Tonnes)			
Fishing activity	Average per family	Total sample	Number
<i>Catching Fish</i>			
Catching of fish			
Quantity harvested	14	265	20
Quantity consumed	2	4	2
Quantity sold	15	269	18
Price received (₹ per kg)	53	1005	19
<i>Rearing Fish</i>			
Fishing Activity	Average	Total	Number
Quantity harvested	16	286	18
Quantity consumed	3	7	2
Quantity sold	15	257	17
Price received (₹ per kg)	53	790	15

In the case of rearing fish on an average, by a respondent quantity of 16 is harvested with quantity of 3 being consumed, selling quantity of 15 for price of Rs.53 per kg. On totality, 18 respondents harvested quantity of 286, 2 respondents consumed quantity of 7 and 17 respondents sold quantity of 257 for Rs. 790 on total.

**Marketing channels identified in the study area**

The general sales are in local markets by all the farmers. However prawns are sold through commission agents who in turn sell at Calcutta market by transporting through railway from Miryalaguda to Calcutta.

1. Fishermen ----- Consumer at the local market
2. Fishermen ---- Commission agent/trader ---- wholesaler at Calcutta ----- Retailers ----



Consumer

3. Shrimp Growers --- Commission agent/trader --  
-- wholesaler at Calcutta ----- Retailers ----  
consumer

The figure below shows the marketing channels and agents involved in the marketing channels. If the farmers in the study area are linked to the markets through efficient value chain would reduce number of intermediaries in the chain, and strengthen the value-adding activities by better technology and inputs, upgraded infrastructure and processing and exports (Miller & Jones, 2010; Pabuayon *et al.*, 2009). This process can ultimately raise the income of farmers and will provide incentive for improving their management practices towards higher farm productivity.

### **CONCLUSIONS**

The sample farmers in Nalgonda district doesn't have the awareness of application of lime, FYM, removal of weeds, selection of disease free seed stock, mixing of

different varieties of seed stock, maintaining adequate population, providing supplementary feed, timely harvesting and usage of proper netting devises. Few farmers had the awareness of providing fingerlings instead of seed. If the farmers are provided with the training programmes on better marketing and value addition concepts the fishery sector which is emerging can be the fastest growing sector in Telangana state

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## **Profitability from Green Pea vis-a-vis Competing Crops-An Alternative for Increasing Farmer's Income in Punjab**

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### **ABSTRACT**

*This study was undertaken to examine the cost-return structure of green pea and major competing crops in Punjab. The requisite primary data were collected to accomplish the objectives of the study. District Amritsar was purposively selected for the study which was having highest area under pea cultivation in the state. A sample of 100 farmers growing pea crop were selected randomly for the study. Selected farmers were divided into three categories on the basis of operational holding size. The data were analyzed by using simple tabular analysis and other statistical tools. The study revealed that green pea growing was found to be more profitable than its major competing crop i.e. potato. The results further revealed that the cultivation of main season pea crop was more profitable than the late season crop. Also, pea-potato and potato-pea crop rotations were found to be more profitable than wheat crop during Rabi season. Labour use pattern inferred that pea picking was the major farm operation utilizing about 93 per cent of the total labour force employed. Gross returns from pea growing were higher on large farms due to comparatively higher average yield realized on these farms while returns over variable cost were also higher on large farms despite higher total variable cost as compared to other farm categories. Input-output ratio was highest (2.16) on large farms while lower on small (2.13) and medium (2.03) farm categories. Thus, pea-potato/ potato-pea crop rotation can be one of the alternatives to enhance farmer's income. Besides, the study brought out that the pea growing farmer's especially small ones should be educated through various training programmes to decrease their cost of production by making judicious use of scarce farm resources. Also, good quality pea seed should be made available to the farmers at reasonable prices to stop their exploitation at the hands of private seed producers.*

### **Keywords**

Competing crops, cost-return structure, crop rotation, input-output ratio

### **JEL Codes**

C85, D24, Q12

### **INTRODUCTION**

Vegetables potentially contribute to the national economy and it has been widely recognized in the recent years. Vegetables have a vital place in the foods of our vegetarian society to improve the dietary standards of the people. India is the second largest producer of vegetables next to China in the world with a production of 162 million tonnes (Anonymous, 2013). Important vegetable crops which are daily used in our diet are potato, onion, garlic, etc. During winter season pea is an important vegetable crop which is widely consumed in India. The nutritional facts of pea are that it is sweet and delicious. It is a rich source of protein, carbohydrates, vitamins A and C, calcium and phosphorous. Pea probably originated in the Sub-Himalayan plains of the North-West India. Green peas are now grown throughout the world in nearly every climate and time zone, both fresh and dried. Currently

Canada is the largest world producer and green pea exporter, which produces roughly three million tonnes every year, with France, China, Russia and India also being large producers. Also, India is the world's largest green pea importer. Green peas are recognized as world's healthiest food. It is used as a vegetable and also as dry pulse. In India green peas are used for preparing various dishes as a core of ingredient. Pea pudding is traditional dish in UK. Same way in North America split pea soup is traditional dish. This versatile legume is one of the major commercial crops grown all over the temperate and semi-tropical regions. Among vegetables, pea occupies an important position. Botanically, pea plant is an herbaceous vine. Some of the important name includes English pea, sweet pea and garden pea etc.

Major green pea producing states in India are Karnataka, Madhya Pradesh, Rajasthan, West Bengal,

Assam, Himachal Pradesh, Uttar Pradesh, Bihar, Haryana and Punjab. However, Uttar Pradesh accounts for 70 per cent of the total pea production in India (www.indiastat.com, 2014). The area under green peas in Punjab was 13.2 thousand hectares in 1995-96 which increased to 13.5 thousand hectares in 2001-02. The production and productivity of green pea was 79.7 thousand tonnes and 6040 kg per hectare in 1995-96, respectively, while the corresponding figure for 2001-02 was 86.3 thousand tonnes and 6000 kg per hectare, respectively. The area under pea in Punjab during the year 2009-10 was 18.7 thousand hectares with production of 114 thousand tonnes while during the year 2014-15 the area was 22.15 thousand hectares with production of 228 thousand tonnes (Anonymous, 2015).

It has been highlighted by various studies that paddy - wheat monoculture has resulted in creating various ecological and environmental problems. So, vegetables especially green pea can be one of the alternatives to decrease area under wheat for increasing farmer's income. Hence, the present study was planned to work out the returns from green pea vis-a-vis its major competing crops.

#### METHODOLOGY

In order to work out the returns from green pea and its major competing crop, a field survey was planned. Firstly, district Amritsar was purposively selected for the study which is having maximum area under pea crop. At next stage, two blocks namely Jandiala Guru and Majitha were selected on the same criteria i.e. with maximum area under pea cultivation. From each selected block, a cluster

of four villages was selected randomly and from each cluster, 50 pea growers were selected randomly thereby making a sample of 100 pea growers for the study.

The primary data were collected from the respondent farmers with the help of especially designed and pre-tested schedule through personal interview method. The data collected from the respondent farmers related to; age, education of the family head, operational holding, cropping pattern followed, source of seed, various production inputs used/practices applied, cost and returns structure, pattern of disposal of produce, packaging, handling along with transportation charges for pea and competing crops.

#### RESULTS AND DISCUSSION

##### Returns from Green Pea

In this section analysis of the various economic aspects of green pea cultivation have been discussed which included production practices of green pea, cost of growing and returns realized by the respondents.

##### Production practices for green pea

A perusal of Table 1 represents the various production practices in pea cultivation on the sample farms. The area under pea in the case of small, medium and large category farms was 0.65, 1.21 and 2.45 hectare, respectively. The overall figures turned out to be 1.46 hectare. The use of seed per hectare increased as the size of farm increased. As such seed used per hectare for small, medium and large farms was 95, 96 and 97 kg per hectare, respectively. At overall level, seed used was found to be 95 kg per hectare. The use of urea was found to be 130 kg per hectare on the

**Table 1: Pea production practices followed on the sample farms in Punjab, 2015-16**

Particular	Farm size category				
	Units	Small	Medium	Large	Overall
Pea area per farm	Ha	0.65	1.21	2.45	1.46
Seed	Kg/ha	95	96	97	95
Seed treatment	gm/ha	90	82	97	87
Urea	Kg/ha	130	135	138	133
Di-ammonium phosphate (DAP)	Kg/ha	258	257	260	256
Farm yard manure (FYM)	tonnes/ha	3.95	4.08	4.45	4.00
Plant protection	No. of sprays	3.94	4.12	4.20	4.14
Human labour					
(a) Family labour	Hrs/ha	19.65 (3.98)	11.15 (1.92)	11.03 (1.74)	14.75 (2.58)
(b) Hired labour	Hrs/ha	465.67 (94.43)	553.48 (95.39)	600.88 (95.09)	542.65 (94.94)
(c) Permanent labour	Hrs/ha	7.83 (1.59)	15.59 (2.69)	20.00 (3.17)	14.18 (2.48)
Total human labour	Hrs/ha	493.15 (100.00)	580.22 (100.00)	631.91 (100.00)	571.58 (100.00)
Tractor	Hrs/ha	12.15	12.52	13.47	12.78
Irrigation	Number	3.87	4.05	4.12	4.03
Electric motor /submersible pump	Hrs/ha	19.35	20.25	20.60	20.15
Green pea yield	Kg/ha	6983	7226	8041	7439

*Figures in parentheses are percentages of the total human labour*

small farms while the corresponding figures for medium and large farms were 135 and 138 kg per hectare, respectively. In overall, urea use turned out to be 133 kg per hectare. The use of Di-ammonium phosphate (DAP) was more prevalent among sample farmers. This may be due to the reason that the DAP is a good source of both nitrogen and phosphorus for the crop. The quantities of DAP used on the small, medium and large farms were estimated to be 258, 257 and 260 kg per hectare, respectively. In overall, DAP use was estimated to be 256 kg per hectare. The results further revealed that on large farms FYM applied was 4.45 tonnes per hectare followed by medium (4.08 t/ha) and small (3.95 t/ha) farms. In plant protection measures number of sprays were highest on large farms (4.20) followed by medium (4.12) and small (3.94) farms. The figure clearly shows that the farmers used required number of sprays to control the incidence of insect/pest attack on their crop. The total human labour use on small, medium and large farms was 493.15, 580.22 and 631.91 hours per hectare, respectively with overall figure of 571.58 hours. Out of total human labour use on the sample farms, the share of family labour was 3.98 per cent on small farms, 1.92 per cent on medium farms, 1.74 per cent on large and 2.58 per cent in overall scenario. Hence, family labour use was more on the small farms as compared to other farm category. It was found that on small, medium and large farms, hired labour use was 94.43, 95.39 and 95.09 per cent of total human labour use. Thus, the results revealed that the respondents on medium and large farms used more of hired labour as compared to small farms as they have high purchasing power. The permanent labour use was more on large (3.17 per cent) and medium farms (2.69 per cent) followed by small farms (1.59 per cent).

As far as the use of tractor for various pea growing operations was concerned, on large farms its use was 13.47 hours per hectare followed by medium (12.52 hrs/ha) and small (12.15 hrs/ha) farms. The overall figure of tractor use turned out to be 12.78 hours per hectare. The yield of green pea (pods) was 8041 kg per hectare on large farms followed by medium (7226 kg/ha) and small farms (6983 kg/ha). It clearly shows that the productivity of green pea was higher in large farms as compared to medium and small farms due to better management of input on large farms.

#### Costs incurred in pea growing

In order to estimate the returns from pea growing it is necessary to look into various costs incurred in pea growing on the sample farms. Constituents of total variable cost incurred in pea growing on sample farms have been given in Table 2. A perusal of the Table 2 reveals that 37.04 per cent of total variable cost constituted expenses on seed and seed treatment which was ₹ 20078 per hectare in value terms. Seed and seed treatment cost per hectare was higher on large farms (₹22320) as compared to medium (₹19578) and small (₹19175) farms. The share of fertilizer and manures was

estimated to be 14.18 per cent of total variable cost while that of plant protection measures was 2.02 per cent. There was not much variability in fertilizer use and plant protection measures according to farm size category.

Human labour use was major constituent of total variable cost with relative share of 36.38 per cent in total variable cost valued at ₹19724 per hectare. According to farm size category, there was higher use of hired and permanent labour on large and medium farms while family labour use was more on small farms which shows higher availability of human labour on large farms. Machine labour use was 7.29 per cent of total variable cost in overall scenario while in value terms it was estimated at ₹3950 per hectare. Also, machine labour use

**Table 2: Total variable cost incurred in pea growing on the sample farms in Punjab, 2015-16**

Particulars	Farm size category			
	Small	Medium	Large	Overall
	(₹/ha)			
<b>1. Seed and seed treatment</b>				
i) Seed	19075	19483	22215	19981
ii) Seed treatment	100	95	105	97
Sub total	19175 (37.22)	19578 (36.72)	22320 (38.64)	20078 (37.04)
<b>2. Fertilizers and Manures</b>				
i) Urea	728	756	772	734
ii) Di-ammonium phosphate (DAP)	6192	6168	6240	6144
iii) Farm yard manure (FYM)	785	860	882	810
Sub total	7705 (14.96)	7784 (14.60)	7894 (13.67)	7688 (14.18)
<b>3. Plant protection measures</b>				
i) Weedicide	661	667	675	667
ii) Pesticide	424	429	433	426
Sub total	1085 (2.11)	1096 (2.06)	1108 (1.92)	1093 (2.02)
<b>4. Human labour</b>				
i) Family labour	850	487	472	636
ii) Hired labour	16796	18318	19302	18491
iii) Permanent	334	667	835	597
Sub total	17980 (34.90)	19472 (36.53)	20609 (35.67)	19724 (36.38)
<b>5. Machine labour</b>	3808 (7.39)	3840 (7.20)	4125 (7.14)	3950 (7.29)
<b>6. Irrigation cost</b>	1191 (2.31)	947 (1.78)	1068 (1.85)	1072 (1.98)
<b>7. Interest on variable cost @ 9 per cent for half of crop period</b>	573 (1.11)	593 (1.11)	643 (1.11)	603 (1.11)
<b>Total variable cost</b>	<b>51517 (100.00)</b>	<b>53310 (100.00)</b>	<b>57767 (100.00)</b>	<b>54208 (100.00)</b>

Figures in parentheses are the percentages of the total cost

was higher on large farms due to easy availability of farm machinery on these farms as compared to other farm categories.

The total variable cost incurred out to be ₹57767 per hectare on large farms followed by medium (₹53310 /ha) and small (₹51517/ha) farms. In overall, ₹54208 per hectare were spent on sample farms for growing pea crop.

#### Returns from green pea growing on sample farms

The returns from green pea growing on per hectare basis have been presented in Table 3. The analysis revealed that the gross returns from pea production came out to be ₹109982, ₹108029 and ₹124636 on small, medium and large farms, respectively. Returns over variable cost from pea growing were estimated after deducting the total variable cost from gross returns. Returns over variable cost (ROVC) per hectare were estimated to be ₹58465, ₹54719 and ₹66869 on small, medium and large farms, respectively while in overall it was ₹60353 per hectare. The input-output ratio was found to be having no specific relationship with the farm size. This showed that a small farmer earned ₹2.13 by investing rupee one on pea growing while by investing the same amount, medium and large growers earned ₹2.03 and ₹2.16 per hectare, respectively. This indicates that there was a net return of ₹1.13, ₹1.03, and ₹1.16 on small, medium and large farms, respectively for an investment of rupee one on pea production. This highlights that the large farmers were more efficient in utilizing the resources judiciously in raising pea as compared to their small and medium counterpart.

#### Returns from Potato

This part includes production practices of potato, cost of growing and returns realized by the respondents.

#### Production practices for potato

A perusal of Table 4 reveals the various production practices in potato cultivation on the sample farms. The area under potato in the case of small, medium and large category farms was 0.13, 1.16 and 1.56 hectare, respectively. The overall figures turned out to be 0.95 hectare. As such seed used in potato growing per hectare on small, medium and large farms was 34, 32 and 36 quintal, respectively. At overall level, seed used was found to be 34 quintals per hectare. The use of urea was

estimated to be 391 kg per hectare on the small farms while the corresponding figures for medium and large farms were 380 and 399 kg, respectively. In overall, urea use turned out to be 390 kg per hectare in potato cultivation. The quantities of DAP used on the small, medium and large farms worked out to be 425, 415 and 435 kg per hectare, respectively. In overall, DAP use was estimated to be 425 kg per hectare. The use of MOP on small farms were 90 kg per hectare with higher use on medium (97 kg/ha) and large (95 kg/ha) farms. The results further revealed that on large farms FYM applied to potato crop was 9.41 tonnes per hectare followed by medium (8.41 t/ha) and small (7.87 t/ha) farms. In plant protection measures number of sprays to control pest and diseases were highest on large farms (4.54) followed by small (4.12) and medium (4.10) farms. The figure clearly shows that chemical control of pests and diseases was higher in large farms.

Total human labour use on small, medium and large farms was 478.21, 488.16 and 496.09 hours per hectare, respectively with overall figure of 487.83 hours. Out of total human labour use on the sample farms, the share of family labour was 6.23 per cent on small farms, 3.22 per cent on medium farms, 3.15 per cent on large and 4.18 per cent in overall scenario. So, it can be concluded that small farmers used more family labour as compared to the medium and large counterparts. It was seen that on small, medium and large farms hired labour use was 91.29, 90.80 and 91.07 per cent of total human labour use. The permanent labour use was more on medium (5.98per cent) and large (5.78per cent) farms followed by small farms (2.48per cent). As far as the use of tractor for various potato growing operations was concerned, on large farms its use was 26.17 hours per hectare followed by small (25.63 hr/ha) and medium (25.05 hr/ha) farms. The overall estimate of tractor use turned out to be 25.82 hours per hectare. The yield of potato was 271.35 quintals per hectare on large farms followed by small (262.44 q/ha) and medium farms (221.92 q/ha). Better yield on large farms can be contributed to better seed quality and management aspects followed by the farmers.

#### Costs incurred in potato growing

In order to estimate the net returns from potato growing it is pre-requisite to look into various costs incurred in potato growing. Constituents of total variable

**Table 3: Returns from pea growing on sample farms in Punjab, 2015-16**

Particular	Farm size category			(₹Per hectare)
	Small	Medium	Large	Overall
Green pea productivity (kg/ha)	6983	7226	8041	7439
Average price received (Rs/kg)	15.75	14.95	15.50	15.40
Gross returns	109982	108029	124636	114561
Total variable cost	51517	53310	57767	54208
Returns over variable cost (ROVC)	58465	54719	66869	60353
Input-output ratio	2.13	2.03	2.16	2.11

**Table 4: Potato production practices followed on sample farms in Punjab, 2015-16**

Particular	Farm size category				
	Units	Small	Medium	Large	Overall
Potato area per hectare	Ha	0.13	1.16	1.56	0.95
Seed	Qtl/ha	34	32	36	34
Seed treatment	Gm/ha	80	92	82	83
Urea	Kg/ha	391	380	399	390
Di-ammonium phosphate (DAP)	Kg/ha	425	415	435	425
Muriate of potash (MOP)	Kg/ha	90	97	95	92
Farm yard manure (FYM)	tonnes/ha	7.87	8.41	9.41	8.20
Plant protection	No. of sprays	4.12	4.10	4.54	4.21
<b>Human labour</b>					
(a)Family labour	Hrs/ha	29.78 (6.23)	15.67 (3.22)	15.65 (3.15)	20.38 (4.18)
(b)Hired labour	Hrs/ha	436.57 (91.29)	443.28 (90.80)	451.76 (91.07)	445.20 (91.26)
(c)Permanent labour	Hrs/ha	11.86 (2.48)	29.21 (5.98)	28.68 (5.78)	22.25 (4.56)
Total human labour	Hrs/ha	478.21 (100.00)	488.16 (100.00)	496.09 (100.00)	487.83 (100.00)
Tractor	Hrs/ha	25.63	25.05	26.17	25.82
Irrigation	Number	7.34	7.16	7.86	7.49
Electric motor/submersible pump	Hrs/ha	36.70	35.80	39.30	37.45
Potato yield	Q/ha	262.44	221.92	271.35	251.90

Figures in parentheses are the percentage of the total labour

cost incurred in potato growing on sample farms have been given in Table 5. A perusal of results revealed that 34.06 per cent of total variable cost incurred on seed and seed treatment which was ₹23439 per hectare in value terms. Seed and seed treatment cost per hectare was higher on large farms (₹25304) as compared to small (₹22723) and medium (₹22296) farms. The share of fertilizer and manures was estimated to be 22.23 per cent of total variable cost while that of plant protection measures was 2.41 per cent.

Human labour use was major component of total variable cost with relative share of 25.46 per cent which was valued at ₹17515 per hectare. According to farm size category, there was higher use of family labour on small farms while hired and permanent labour use was more on medium and large farms. Machine labour use was 13.43 per cent of total variable cost in overall scenario while in value terms it was estimated to be ₹9224 per hectare. Thus, machine labour use was higher on large farms due to better machinery access as compared to other farm categories.

The total variable cost incurred in potato cultivation turned out to be ₹72844 per hectare on large farms followed by small (₹67307/ha) and medium (₹67144/ha) farms. In overall, ₹68821 per hectare were spent on growing potato crop on the selected farms.

#### Returns from potato growing on sample farms

The returns from potato crop on per hectare basis have been presented in Table 6. It is quite obvious from the Table 6 that the gross returns from potato growing on small farms came out to be ₹93166 per hectare while it was ₹88324 and ₹111796 on medium and large farms, respectively. Returns over variable cost (ROVC) per hectare were estimated to be ₹25859, ₹21180 and ₹38952 on small, medium and large farms, respectively while in overall scenario it was ₹28917 per hectare. The input-output ratio was not having any relationship with farm size. This showed that a small farmer earned ₹1.38 by spending rupee one on potato growing while by investing the same amount medium and large growers earned ₹1.32 and ₹1.53, respectively. This shows the judicious farm input use on large farms.

#### Returns from Wheat

This part includes production practices of wheat, cost of growing and returns realized by the respondents.

#### Production practices for wheat

A perusal of Table 7 represents the various production practices in wheat cultivation on the sample farms. The area under wheat in the case of small, medium and large category farms was 0.58, 1.35 and 2.83 hectare, respectively. The overall figures turned out to be 1.63

**Table 5: Total variable cost incurred in potato growing on sample farms in Punjab, 2015-16**

Particulars	Farm size category			
	( $\text{₹}/\text{ha}$ )			
	Small	Medium	Large	Overall
<b>1. Seed and Seed treatment</b>				
i) Seed	22641	22211	25214	23355
ii) Seed treatment	82	85	90	84
Sub total	22723 (33.76)	22296 (33.21)	25304 (34.74)	23439 (34.06)
<b>2. Fertilizer and Manure</b>				
i) Urea	2225	2126	2301	2217
ii) Di-ammonium phosphate (DAP)	9910	9896	10213	9996
iii) Muriate of potash (MOP)	1587	1593	1989	1723
iv) Farm yard manure (FYM)	1400	1870	2090	1430
Sub total	15122 (22.47)	15485 (23.06)	16593 (22.78)	15366 (22.23)
<b>3. Plant protection</b>				
i) Weedicide	1175	1169	1186	1179
ii) Pesticide	491	462	494	482
Sub total	1666 (2.48)	1631 (2.43)	1680 (2.31)	1661 (2.41)
<b>4. Human labour</b>				
i) Family labour	1265	670	665	878
ii) Hired labour	15598	15518	15819	15679
iii) Permanent	520	1261	1208	958
Sub total	17383 (25.82)	17449 (25.98)	17692 (24.28)	17515 (25.46)
5. Machine labour	9214 (13.69)	8955 (13.34)	9329 (12.81)	9224 (13.43)
6. Irrigation cost	450 (0.67)	581 (0.87)	1436 (1.97)	830 (1.21)
7. Interest on variable cost @ 9 per cent for half of period under potato	749 (1.11)	747 (1.11)	810 (1.11)	766 (1.11)
Total variable cost	67307 (100.00)	67144 (100.00)	72844 (100.00)	68821 (100.00)

Figures in parentheses are the percentage of the total cost

hectare. The use of seed per hectare increased as the size of farm increased. As such seed used per hectare for small, medium and large farms was 95.35, 102.54 and 106.82 kg per hectare, respectively. At overall level, seed used was found to be 101.71 kg per hectare. The use of urea was found to be 250 kg per hectare on the small farms while the corresponding figures for medium and large farms were 275 and 270 kg per hectare, respectively. In overall urea use turned out to be 260 kg per hectare. The quantities of DAP used on the small, medium and large

**Table 6: Returns from potato growing on sample potato farms in Punjab, 2015-16**

Particular	Farm size category			
	(Per hectare)			
	Small	Medium	Large	Overall
Potato productivity (qtl/ha)	262.44	221.92	271.35	251.90
Average price received ( $\text{₹}/\text{qtl}$ )	355	398	412	388
Gross returns	93166	88324	111796	97737
Total variable cost	67307	67144	72844	68821
Returns over variable cost (ROVC)	25859	21180	38952	28917
Input-output ratio	1.38	1.32	1.53	1.42

farms were estimated to be 135, 140 and 142 kg per hectare, respectively. In overall, DAP use was estimated to be 138 kg per hectare. The results further revealed that on medium farms FYM applied was 4.50 tonnes per hectare followed by large (4.21 t/ha) and small (3.94 t/ha) farms. In plant protection measures number of sprays were highest on medium farms (4.91) followed by large (4.82) and small (4.56) farms. The figure clearly shows that the farmers used required number of sprays to control the incidence of insect/pest and diseases attack on their crop. The total human labour use on small, medium and large farms was 121.34, 119.63 and 118.37 hours per hectare, respectively with overall figure of 118.60 hours. Out of total human labour use on the sample farms, the share of family labour was 16.01 per cent on small farms, 11.58 per cent on medium farms, 10.69 per cent on large and 12.93 per cent in overall scenario. So, it can be concluded that small farmers utilized more of family labour on their farms as compared to the medium and large ones. It was found that on small, medium and large farms, hired labour use was 75.11, 73.10 and 72.54 per cent of total human labour use. The permanent labour use was more on large (16.77 per cent) and medium (15.32 per cent) followed by small farms (8.88 per cent). As far as the use of tractor for various wheat growing operations was concerned on large farms its use was 10.50 hours per hectare followed by medium (9.67 hr/ha) and small (9.31 hr/ha) farms. The overall figure of tractor use turned out to be 9.83 hours per hectare. The yield of wheat was 4720 kg per hectare on large farms followed by small (4700 kg/ha) and medium farms (4669 kg/ha). It clearly shows that the productivity of wheat was higher in large farms as compared to small and medium farms due to better management of input on large farms.

#### Costs incurred in wheat growing

In order to estimate the returns from wheat crop it is necessary to look into various costs incurred in wheat growing on the sample farms. Expenses on various inputs used in wheat growing on sample farms have been given

**Table 7: Wheat production practice followed on sample farms in Punjab, 2015-16**

Particular	Farm size category				
	Units	Small	Medium	Large	Overall
Wheat area per farm	Ha	0.58	1.35	2.83	1.63
Seed	Kg/ha	95.35	102.54	106.82	101.71
Seed treatment	gm/ha	190	184	192	187
Urea	Kg/ha	250	275	270	260
Di-ammonium phosphate (DAP)	Kg/ha	135	140	142	138
Farm yard manure (FYM)	tonnes/ha	3.94	4.50	4.21	4.09
Plant protection	No. of sprays	4.56	4.91	4.82	4.72
<b>Human labour</b>					
(a)Family labour	Hrs/ha	19.43 (16.01)	13.86 (11.58)	12.65 (10.69)	15.34 (12.93)
(b)Hired labour	Hrs/ha	91.14 (75.11)	87.45 (73.10)	85.87 (72.54)	87.18 (73.50)
(c)Permanent labour	Hrs/ha	10.77 (8.88)	18.32 (15.32)	19.85 (16.77)	16.08 (13.57)
Total human labour	Hrs/ha	121.34 (100.00)	119.63 (100.00)	118.37 (100.00)	118.60 (100.00)
Tractor	Hrs/ha	9.31	9.67	10.50	9.83
Irrigation	Number	5.98	5.65	6.03	5.45
Electric motor/submersible pump	Hrs/ha	25.98	25.65	30.03	27.45
Wheat yield	Kg/ha	4700	4669	4720	4697

*Figures in parentheses are percentages of the total Humanlabour*

in Table 8. A perusal of the table reveals that 12.73 per cent of total variable cost constituted expenses on seed and seed treatment which was ₹3659 per hectare in value terms. Seed and seed treatment cost per hectare was higher on large farms (₹3812) as compared to medium (₹3704) and small (₹3470) farms. The share of fertilizer and manures was estimated to be 31.97 per cent of total variable cost while that of plant protection measures was 3.39 per cent.

Human labour use was major constituent of total variable cost with relative share of 23.76 per cent in total variable cost valued at ₹6828 per hectare. According to farm size category, there was higher use of hired and family labour on small and medium farms while permanent labour use was more on large farms which shows higher availability of family labour on small farms. Machine labour use was 23.08 per cent of total variable cost in overall scenario while in value terms it was estimated at ₹6634 per hectare. Also, machine labour use was higher on large farms due to easy availability of farm machinery on these farms as compared to other farm categories.

The total variable cost incurred turned out to be ₹30340 per hectare on large farms followed by medium (₹29355/ha) and small (₹27590/ha) farms. In overall, ₹28740 per hectare was total variable cost increased on growing wheat crop on sample farms.

#### **Returns from wheat growing on sample farms**

The returns from wheat crop on per hectare basis have

been presented in Table 9. A perusal of the results revealed that the gross returns per hectare from wheat cultivation came out to be ₹77900 on small, ₹75653 on medium, ₹76585 on large farms and ₹76837 in overall scenario. Returns over variable cost (ROVC) from wheat crop were estimated by deducting the total variable cost from gross returns. Returns over variable cost (ROVC) per hectare were estimated to be ₹50310, ₹46298 and ₹46245 on small, medium and large farms, respectively while in overall scenario it was ₹48097 per hectare. The input-output ratio was found to be having indirect relationship with the farm size. The input-output ratio showed that a small farmer earned ₹2.82 by investing rupee one on wheat growing while by investing the same amount, medium and large farmers earned ₹2.58 and ₹2.52, respectively. This indicates that by investing rupee one there was a net return of ₹1.82, ₹1.58 and, ₹1.52 on small, medium and large farms, respectively. This showed the small farmer was more efficient in utilizing the resources as compared to medium and large counterparts.

#### **Comparative Analysis**

The comparative analysis was undertaken by comparing gross returns, returns over variable cost and input-output ratio of green pea and competing crops.

#### **Comparative returns from pea vis-à-vis potato**

Table 10 showed comparative returns from pea vis-à-vis potato. A perusal of the results revealed that gross returns were estimated to be higher from main season pea

**Table 8: Total variable cost incurred in wheat growing on sample farms in Punjab, 2015-16**

Particulars	Farm size category			
	Small	Medium	Large	Overall
(₹/ha)				
<b>1.Seed and Seed treatment</b>				
i)Seed	3150	3395	3488	3347
ii)Seed treatment	320	309	324	312
Sub total	3470 (12.58)	3704 (12.74)	3812 (12.56)	3659 (12.73)
<b>2.Fertilizer and Manure</b>				
i)Urea	1400	1540	1512	1456
ii)Di-ammonium phosphate (DAP)	3240	3360	3408	3312
iii)Farm yard manure (FYM)	3995	4695	4635	4421
Sub total	8635 (31.30)	9595 (32.69)	9555 (31.49)	9189 (31.97)
<b>3.Plant protection and measures</b>				
i)Weedicide	835	825	860	840
ii)Pesticide	139	132	142	135
Sub total	974 (3.52)	957 (3.27)	1002 (3.30)	975 (3.39)
<b>4.Human labour</b>				
i)Family labour	835	590	544	661
ii)Hired labour	5711	5514	5295	5482
iii)Permanent labour	425	745	857	685
Sub total	6971 (25.27)	6849 (23.33)	6696 (22.07)	6828 (23.76)
<b>5.Machine labour</b>				
	6028 (21.28)	6560 (22.33)	7071 (22.31)	6634 (23.08)
<b>6.Irrigation cost</b>				
	905 (3.28)	1009 (3.44)	1536 (5.06)	823 (2.87)
<b>7.Interest on variable cost @ 9per cent for half of the crop period</b>				
	607 (2.20)	645 (2.20)	668 (2.20)	632 (2.20)
<b>Total variable cost</b>	<b>27590 (100.00)</b>	<b>29355 (100.00)</b>	<b>30340 (100.00)</b>	<b>28740 (100.00)</b>

Figures in parentheses are the percentage of the total cost

**Table 9: Returns from wheat growing on sample wheat farms in Punjab, 2015-16**

Particular	Farm size category			Over all
	Small	Medium	Large	
(₹/ha)				
Wheat productivity (kg/ha)	4700	4669	4720	46.97
Minimum support price	1450	1450	1450	1450
Returns	68150	67701	68440	68107
Value of by product	9750	7952	8145	8730
Gross returns	77900	75653	76585	76837
Total variable cost	27590	29355	30340	28740
Returns over variable cost (ROVC)	50310	46298	46245	48097
Input-output ratio	2.82	2.58	2.52	2.67

(₹119072 /ha) as compared to potato (₹82486 /ha) while total variable cost was higher in case of potato thereby fetching lower returns.

Similarly, gross returns were higher from late season pea (₹109744/ha) than late season potato (₹92315/ha) while total variable cost was higher in raising potato thereby getting lower returns. Input-output ratio was higher in pea as compared to potato. Thus, the results revealed that green pea was more profitable than competing crop i.e. potato even when sown at different sowing time.

**Comparative returns from pea-potato crop rotation vis-à-vis wheat**

Table 11 shows the comparison of returns from pea-potato crop rotation vis-à-vis wheat. A perusal of the results revealed that gross returns were higher from pea-potato crop rotation (₹211389/ha) as compare to wheat

**Table 10: Comparative returns from pea vis-à-vis potato in Punjab, 2015-16**

Particular	Main season pea vis-à-vis-potato		Late season pea vis-à-vis late season potato	
	Main season pea	Potato	Late season pea	Late season potato
Gross returns	119072	82486	109744	92317
Total variable cost	56731	63231	53985	67587
Returns over variable cost (ROVC)	62341	19255	58299	24730
Input-output ratio	2.10	1.30	2.03	1.37
Sowing time	October	Mid October	January	End of January
Harvesting/picking time	December	Mid December	March	End of March

**Table 11: Comparative returns from pea-potato crop rotation vis-à-vis wheat in Punjab, 2015-16**  
(₹/ha)

Particular	Wheat	Pea-potato rotation
Gross returns	76837	211389
Total variable cost	28740	124318
Returns over variable cost (ROVC)	48097	87071 (81.03)*
Input-output ratio	2.67	-

\*per cent deviation in ROVC

**Table 12: Comparative returns from potato-pea crop rotation vis-à-vis wheat in Punjab, 2015-16**  
(₹/ha)

Particular	Wheat	Pea-potato rotation
Gross returns	76837	192230
Total variable cost	28740	117216
Returns over variable cost (ROVC)	48097	77554 (37.98)*
Input-output ratio	2.67	-

\*per cent deviation in ROVC

(₹76837/ha). It was seen that total variable cost was also higher in pea-potato crop rotation. The returns over variable cost (ROVC) were about 81 per cent higher in pea-potato crop rotation than wheat crop.

#### Comparative returns from potato-pea crop rotation vis-à-vis wheat

Table 12 shows the comparison of returns from potato-pea crop rotation vis-à-vis wheat. A perusal of the Table 12 reveals that gross returns were estimated to be higher from potato-pea crop rotation (₹192230/ha) as compared to wheat (₹76837/ha). Also, total variable cost was also higher in potato-pea crop rotation. The returns over variable cost (ROVC) were about 61 per cent higher in potato-pea crop rotation as compared to wheat crop.

#### CONCLUSIONS AND POLICY ISSUES

The study brought out some conclusions and policy issues. It was found that pea picking was major component of human labour use in pea cultivation which was nearly 93 per cent of the total human labour use on the sample farm. Family labour use was higher on small farms as compared to medium and large farm categories due to higher proportion of male members on small farms. Total variable cost incurred in growing pea on sample farms was higher on large farms as compared to medium and small farm categories due to higher human/machine labour use, expenses on seed, fertilizer/manures and plant protection measures. Green pea productivity was higher on large farms due to better production practices followed on these farms as compared to medium and small farms. Returns over variable cost and input-output ratio in pea cultivation were higher on large farms as compared to other farm categories due to comparatively better gross returns. Green pea fetched higher returns as compared to its major competing crop potato even if sown as main season or late season crop. Also, main season pea fetched slightly higher returns as compared to late season pea. Green pea-potato and potato-green pea crop rotations fetched higher returns than wheat crop on the sample farms and thus can be one of the alternatives of increasing farmers' income.

The pea growing farmer's especially small ones should be educated through various training programmes to decrease their cost of production by making judicious use of resources. Also, good quality pea seed should be made available to the farmers at reasonable prices to stop their exploitation at the hands of private seed producers.

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## **Rapeseed and Mustard Cultivation in Bathinda District -An Appraisal of Productivity and Profitability**

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### **ABSTRACT**

*An attempt has been made in this study (1) to estimate the costs and returns structure in the production of rapeseed and mustard (2) to ascertain the gaps in productivity of rapeseed and mustard at various levels i.e. at actual farm, state and district levels and (3) to identify the constraints in the production of rapeseed and mustard and suggest measures for improving production and productivity of rapeseed and mustard in Bathinda district of Punjab. Primary data during 2015-16 were collected from 80 farmers comprised of 27 small, 47 medium and 6 large farmers from four villages of Talwandi Sabo and Sangat blocks of Bathinda district. The total fixed costs per acre were estimated to be Rs. 7277.90, Rs. 7312.94 and Rs. 4974.27 while per acre total variable costs came out to be Rs. 7612.87, Rs. 7311.01 and Rs. 7138.11 respectively on the small, medium and large farms. The returns over variable costs were found highest on large farms (Rs. 15545.05) as compared to medium (Rs. 12951.18) and small (Rs. 11908.51) farms. Total cost per quintal of output was estimated to be the lowest on the large farms (Rs. 2053.66) which might be due to operation of economies of scale. The per cent profit margin was estimated to be 23.72, 27.82 and 46.60 per cent on small, medium and large farms respectively. The results of productivity analysis showed that at overall the actual yield was found less than the yield of PAU recommended variety (PBR 357) by 3.50 quintal per acre. This gap could be narrowed down by making available better quality farm inputs, control of pesticides and insecticides, weed control and disease management. High cost of inputs, shortage of labour, non-availability of quality inputs particularly plant protection chemicals, incidence of pests and diseases were important production constraints and overcoming these constraints is critical for improving production and productivity of rapeseed and mustard in the district. Major avenues for future increase in rapeseed and mustard production are expected to come from enhancement in productivity of this crop. A combination of high yielding varieties and hybrids and efficient crop management needs to be adopted.*

### **Keywords**

Constraints, costs, productivity, profit margin, rapeseed and mustard, returns

### **JEL Codes**

Q12, Q13, Q18

### **INTRODUCTION**

Agriculture sector plays a very important role in India's social security and overall economic welfare. Oilseeds crops are the second most important determinant of agricultural economy, next to cereals. India is the largest producer of oilseeds in the world and accounts for about 14 per cent of the global oilseeds area, seven per cent of the total vegetable oils production and ten per cent of the total edible oil consumption. In 2013-14, the total oilseed cultivated area was 28 million hectares while the total oilseed 'seed' production and the total edible oil production, under the nine oilseeds crops were 29 million metric tonnes (mmt) and 7.4 mmt respectively (Kumar 2014). Among the nine oilseed crops grown in the

country, seven are of edible oils (soybean, groundnut, rapeseed and mustard, sunflower, sesame, safflower and niger) and two are of non-edible oils (castor and linseed). India ranks first in the production of most of the minor oilseeds (castor, niger, safflower and sesame). Rapeseed is normally cultivated as a rabi crop in India as it requires relatively cooler temperatures for seed setting and oil formation. Sowing normally starts in the month of November and the crop season spreads up to April. A large number of species and sub-species of oilseed are cultivated in India under the name rapeseed and mustard seed including Rai, Torah, Brown Sarson, Yellow Sarson, Swedi, Rape/Karan Rai and Taramira.

India is the third largest rapeseed and mustard

producer in the world, accounting for about 12 per cent of the world's total rapeseed and mustard 'seed' and about 8.5 per cent of the world's total rapeseed- mustard 'oil'. Of the total area and production under the nine oilseeds crops grown in India, rapeseed mustard accounts for 22.2 per cent of the acreage and 22.6 per cent of the production. The average rapeseed and mustard yield in India is about 1188 kg/ha compared to the combined oilseeds crops average of 1168 kg/ha in 2013-14 (Anonymous 2015<sub>a</sub>). Though rapeseed and mustard ranks second in terms of production after soybean, however due to more oil content (ranging from 35-46 per cent) rapeseed and mustard ranks first in terms of oil yield among all oilseed crops. Rapeseed and mustard yields are lower in India compared to other rapeseed and mustard producing countries such as Germany (3811 kg/ha), France (3240 kg/ha), China (1834 kg/ha) and Canada (1769 kg/ha) as well as the world average (1849 kg/ha). Rapeseed and mustard yields, which were low (about 647 kg/ha on the average) during the early -1980s, witnessed a steady increase during the last three decades and reached a level of 1121 kg/ha in the recent decade in India. Among the major oilseed producing states, Haryana has the highest yield (1533 kg/ha) followed by Rajasthan (1170 kg/ha) and Uttar Pradesh (1121 kg/ha) while west Bengal (911 kg/ha) has the lowest yield. It is interesting to note that all states witnessed a positive growth in rapeseed and mustard yield during the last three decades but rate of growth was the highest during the decade of 1980s, which decelerated during 1990s but again picked up during the last decade (Sharma, 2014).

Punjab, the main bread basket of the country gained economic prosperity through new agricultural technology in mid-sixties. The paddy-wheat rotation followed in the state has made a success out of the Green Revolution and which has made the country self-sufficient in food grains is presently a cause of concern. The continuous cultivation of paddy-wheat rotation is showing ill-effects that if not checked right now might jeopardize our food security. Crop diversification in Punjab has become essential and in an attempt to shift a chunk of area under water intensive paddy-wheat crops in the state. The government of India has allocated more than 450 crore for demonstrating the viability of alternate crops such as maize, oilseeds and poplar based forestry. Rapeseed and mustard is an important oilseeds crop cultivated in Punjab state. The area under this crop in the state was 30 thousand hectares with the production of 39 thousand metric tonnes while the average yield was about 1306 kg/ha in 2013-14 (Anonymous 2014). The major rapeseed and mustard districts growing in Punjab are Fazilka, Hoshiarpur, S.B.S. Nagar and Bathinda where the area under rapeseed and mustard is 6, 4, 3 and 2 thousand hectares respectively. To step up oilseed production on sustainable basis in the state, diversification of cropping systems has become essential. In this backdrop, the present study was undertaken with the specific objectives

(1) to estimate the costs and returns structure in the production of rapeseed and mustard for different size categories of farmers of Bathinda district (2) to ascertain the gaps in productivity of rapeseed and mustard at various levels i.e. at actual farm, state and district levels and (3) to identify the constraints associated with the production of rapeseed and mustard in the study area and suggest measures for improving production and productivity of rapeseed and mustard.

#### **METHODS AND MATERIALS**

Primary data were collected from the sample households for the year 2015-16. Multistage stratified random sampling technique was used for the selection of sample. Bathinda district was purposively selected for having the highest area under rapeseed and mustard crop in south western zone of Punjab. Out of eight blocks in Bathinda district, two blocks namely Talwandi Sabo and Sangat were selected where the density of rapeseed and mustard growers was higher. At the third stage- two clusters of villages were selected from each block where the concentration of rapeseed and mustard growers was the highest. Each cluster was of two villages.

From each cluster of villages, 20 farmers were selected randomly making a sample of 80 rapeseed and mustard growing farmers for this study. Farmers were then categorized into three categories viz. small, medium and large. The five standard land holding categories were clubbed into three groups to facilitate the comparison. The selection of farmers was done on the basis of probability proportional to the number of farmers in each category. Consequently 27 small, 47 medium and 6 large farmers were selected randomly making a total sample of 80 farmers.

#### **Costs and returns concepts**

##### ***Fixed costs***

These included:

- i. Depreciation on value of fixed assets. Depreciation in an accounting year, therefore, become a cost and is included in the fixed costs. It was calculated by straight line method by deducting junk value from original value and then dividing by number of useful years of assets under study.
- ii. Land rent: It was taken as ₹30,000 per acre being the model rate in sample villages during the study period (2015-16)
- iii. Interest on capital investment: It is taken as 10 per cent per annum on the investment incurred on machinery, equipment etc.

##### ***Variable costs***

The sum total of costs incurred on seeds, fertilizers, plant protection chemicals, human labour, machinery/ tractor hours and interest on working capital for half of the period covered under rapeseed and mustard constitute total variable costs.

##### ***Interest on working capital***

Interest on working capital was computed at the rate of

7 per cent per annum for half of the period covered under rapeseed and mustard.

**Total costs**

It is the sum of variable and fixed costs.

**Gross returns**

Gross returns were worked out by multiplying the total output and the average price received by the farmers.

**Net returns**

Net returns were calculated by deducting the total costs from gross returns

**Analysis of data**

Consistent with the objectives of the study, different techniques were used for the analysis of data.

For the interpretation and comparison of costs and returns from rapeseed and mustard and productivity levels on different sizes of farmers and to generate information on other parameters, tabular analysis was carried out.

Garret's Ranking Technique was used to rank the problems perceived by the sampled respondents. The degree of response with regard to problems faced by sampled respondents was ranked. The most prevalent problem was given 1<sup>st</sup> rank and accordingly the next important problem was ranked on the basis of the severity of the problem.

$$\text{Per cent position} = 100 * (\text{Rij} - 0.5) / \text{Nj}$$

Where

Rij = Rank given for i<sup>th</sup> items/problems by the J<sup>th</sup> respondent

Nj = Number of items/problems ranked by the J<sup>th</sup> respondent

The relative position of each rank is converted into scores by referring the table given by Garrett and Woodworth (1969). Then for each factor problem, the scores of individual respondents were added together and mean score was calculated. The factor with highest mean score was considered to be the most important problem.

**RESULTS AND DISCUSSION**

**The results of the study have been presented as under:**

**Costs and Returns structure in the production of**

**rapeseed mustard**

**Fixed cost**

The perusal of Table 1 reveals that the overall cost on depreciation on fixed assets was 12.61 per cent of the total fixed cost. In case of small farmers the depreciation on fixed assets was higher as it was 19.93 per cent followed by medium (8.82 per cent) and large (8.16 per cent). It was found that the cost of land rent was more on large farms (81.09 per cent). The results further revealed that interest on fixed capital was higher in case of small farmers (32.37 per cent) followed by medium farmers (13.21 per cent) and large farms (10.75 per cent). Total fixed cost was found to be higher in case of medium farms (₹7312.94) as compared to small (₹7277.90) and large (₹4974.27) farms. Overall total fixed cost was to the tune of ₹7125.72 per acre.

**Variable costs**

The total variable costs in production of rapeseed and mustard on different categories of farms in Bathinda district were estimated and are presented in Table 2. The total variable cost was found higher on the small farms as compared to medium and large farms. Out of total variable cost expenditure on seeds was 1.23 per cent of total variable cost. The cost incurred on seed was 1.05, 1.32 and 1.36 per cent for small, medium and large farms respectively. In overall situation the expenditure on urea was 4.15 per cent of the total variable costs. In case of DAP the cost incurred was 11.19 per cent, 12.41 per cent and 13.45 per cent on small, medium and large respectively. Large farmers used more of casual labour on their farms. The cost on the use of family labour for small farmer was 25.73 per cent followed by medium (25.59 per cent) and large (18.64 per cent) farmers and it was observed that small farmers used more of their family members to work on farms. The cost incurred on causal labour was 18.14 per cent, 20.14 per cent and 22.54 per cent by small, medium and large farms respectively. The cost incurred on hiring of machinery was found higher on small farms (31.28 per cent) followed by medium (24.90 per cent) and large farm use (21.64 per cent). The overall expenditure on plant protection measures came out to be

**Table 1: Fixed cost in production of rapeseed and mustard on different categories of farms in Bathinda district, Punjab, 2015-16**

Particulars	Farm size categories			Overall
	Small	Medium	Large	
Depreciation on fixed assets	1450.63 (19.93)	644.72 (8.82)	405.67 (8.16)	898.79 (12.61)
Land rent	3471.06 (47.70)	5702.41 (77.97)	4033.73 (81.09)	4824.18 (69.70)
Interest on fixed capital @ 10 per cent per annum	2356.21 (32.37)	965.81 (13.21)	534.87 (10.75)	1402.75 (19.69)
<b>Total fixed cost</b>	<b>7277.90</b> <b>(100.00)</b>	<b>7312.94</b> <b>(100.00)</b>	<b>4974.27</b> <b>(100.00)</b>	<b>7125.72</b> <b>(100.00)</b>

Figures in parentheses are percentages to their respective totals

**Table 2: Variable costs in production of rapeseed and mustard on different categories of farms in Bathinda district, Punjab, 2015-16**

Sr. No.	Particulars	Farm size categories			Overall
		Small	Medium	Large	
1.	Seed	79.72 (1.05)	96.66 (1.32)	96.75 (1.36)	90.95 (1.23)
2.	Fertilizers				
i.	Urea	297.08 (3.90)	310.80 (4.25)	320.32 (4.49)	306.88 (4.15)
ii.	DAP	852.00 (11.19)	907.20 (12.41)	960.00 (13.45)	892.53 (12.06)
3.	Human labour	3617.40 (47.52)	3800.18 (51.98)	3832.60 (53.69)	3740.91 (50.55)
i.	Family	1958.50 (25.73)	1870.60 (25.59)	1330.30 (18.64)	1859.74 (25.13)
ii.	Casual	1380.60 (18.14)	1472.12 (20.14)	1609.20 (22.54)	1451.50 (19.62)
iii.	Permanent	278.30 (3.66)	457.46 (6.26)	893.10 (12.51)	429.67 (5.80)
4.	Machinery custom hiring	2381.11 (31.28)	1820.11 (24.90)	1545.00 (21.64)	1988.81 (26.88)
5.	Plant protection chemicals	254.63 (3.34)	250.32 (3.42)	260.67 (3.65)	252.55 (3.41)
6.	Interest on variable cost @ 7 per cent for half of period	130.93 (1.72)	125.74 (1.72)	122.77 (1.72)	127.27 (1.72)
	Total Variable Costs	7612.87 (100.00)	7311.01 (100.00)	7138.11 (100.00)	7399.90 (100.00)

Figures in parentheses are percentages to their respective totals

3.41 per cent of the total variable cost. The variable cost in case of small farmers was found to be the highest as it was Rs.7612.87 followed by medium (₹7311.01) and large (₹7138.11) farmers. Interest on variable cost was estimated to the tune of ₹130.93, ₹125.74 and ₹122.77 on small, medium and large farms respectively. On an average, the figure came out to be ₹127.27. The overall total variable cost in the production of rapeseed and mustard was estimated to be ₹7399.90.

#### Economics of rapeseed and mustard

The perusal of Table 3 reveals that the prices per quintal of produce received by small, medium and large farmers were ₹3814.81, ₹3800.38 and ₹3846.02 respectively. The large farmers got better price for their produce than medium and small ones because of their better bargaining power and good quality of produce. On an average, the returns over the variable cost were estimated to be ₹12794.62 while it was ₹11908.51, ₹12951.19 and ₹15545.05 for small, medium and large farms respectively. The net returns from rapeseed and mustard were ₹5668.30 on overall basis while it were ₹4630.61 on small farms, ₹5638.24 on medium farms and ₹10570.78 on large farms in the study area. On an average, the total cost of production of rapeseed and mustard was estimated to be ₹14525.62. The input-output

ratio for small, medium and large farmers came out to be 1.31, 1.39 and 1.87 respectively with overall input-output ratio of 1.39.

#### Profitability indicators

On an average per quintal total cost of output was estimated to be ₹2737.79 and profit margin was estimated to be ₹1068.34 (28.07 per cent). The profit margin for small, medium and large farmers was estimated to be ₹904.79, ₹1057.37 and ₹1792.36 per quintal respectively. The per cent profit margin on small, medium and large farms came out to be 23.72, 27.82 and 46.60 per cent respectively (Table 4).

#### Comparative productivity analysis

The comparative productivity analysis was done for the rapeseed and mustard crop to ascertain the gap between (i) the actual yield of the sampled farmers and PAU recommended variety of rapeseed and mustard (PBR 357) (ii) actual yield of the sampled farmers and state average yield (iii) actual yield of the sampled farmers and average yield of Bathinda district. As presented in Table 5, at overall level, the gap ascertained between the actual yield of the sampled farmers and PAU recommended variety was of 3.50 quintal per acre while on small, medium and large farms it was estimated to be 3.67, 3.48 and 2.94 quintals per acre respectively. Actual

yield of the sampled farmers at overall level was found nearer to the state average yield. But on small farms, the actual yield was found less than the state average yield of rapeseed and mustard. At overall level, actual yield of the sampled farmers was found less than the average yield of rapeseed and mustard of the Bathinda district by 0.36 quintals per acre. Only the yield level of the large sampled farmers was found higher than the average yield of the Bathinda district otherwise the yield of rapeseed and mustard at small farms and medium farms found low by 0.53 quintals and 0.34 quintals per acre respectively.

Since yield of PAU recommended variety is higher than the actual yield of the sampled farmers, there is a need to enhance level of actual yield by making available better quality farm inputs sufficiently at reasonable prices, control of pesticides and insecticides, disease management and weed control measures.

**Constraints in the production of rapeseed and mustard**

The constraints as perceived by rapeseed and mustard farmers during the production of rapeseed and mustard are summarized in Table 6. Though there were many

**Table 3: Economics of rapeseed and mustard production on different categories of farms in Bathinda district, Punjab, 2015-16**

Sr. No.	Particulars	Farm size categories			Overall
		Small	Medium	Large	
<b>1</b>	<b>Main product</b>				
i.	Yield (q)	4.83	5.02	5.56	5.00
ii.	Sale price (₹/q)	3814.81	3800.38	3846.02	3806.13
iii.	Returns (₹)	18425.53	19077.91	21383.87	19030.65
<b>2</b>	<b>By product</b>				
i.	Yield (q)	4.98	5.30	5.63	5.22
ii.	Sale price (₹/q)	220.05	223.45	230.78	222.85
iii.	Returns (₹)	1095.85	1184.29	1299.29	1163.27
<b>3</b>	<b>Gross returns</b>	19521.38	20262.20	22683.16	20193.92
<b>4</b>	<b>Returns over variable costs</b>	11908.51	12951.19	15545.05	12794.02
<b>5</b>	<b>Total cost (₹)</b>	14890.77	14623.95	12112.38	14525.62
<b>6</b>	<b>Net returns (₹)</b>	4630.61	5638.24	10570.78	5668.30
<b>7</b>	<b>Input- Output ratio</b>	1.31	1.39	1.87	1.39

**Table 4: Profitability indicators on different farm size categories in Bathinda district, Punjab, 2015-16**

Particulars	Farm size categories			Overall
	Small	Medium	Large	
Total cost per quintal of output (₹)	2910.02	2743.01	2053.66	2737.79
Average price (₹/q)	3814.81	3800.38	3846.02	3806.13
Profit margin (₹/q) (2-1)	904.79	1057.37	1792.36	1068.34
Profit margin (per cent) (3÷2)x100	23.72	27.82	46.60	28.07

**Table 5: Productivity of rapeseed and mustard at various levels**

Particulars	Farm size categories			Overall
	Small	Medium	Large	
Yield of PAU recommended variety (PBR357)*	8.50	8.50	8.50	8.50
Average yield of state**	5.10	5.10	5.10	5.10
Average yield of Bathinda district**	5.36	5.36	5.36	5.36
Actual yield of the sampled farmers	4.83	5.02	5.56	5.00

Source: \* Anonymous 2015 ; \*\* Anonymous 2015.

**Table 6: Perceived constraints in the production of rapeseed and mustard in Bathinda district, Punjab, 2015-16**

<b>Problem</b>	<b>Total score</b>	<b>Garrett mean score</b>	<b>Rank</b>
Weeds problem	4085	51.06	1
Non availability of good quality plant protection chemicals	3714	46.43	4
Shortage & high cost of Labour	2293	28.66	7
Non-availability of suitable varieties	1769	22.11	8
High interest on credit	3855	48.19	3
High input cost and untimely availability	2367	29.59	6
Incidence of insect pest attack	3166	39.58	5
Inadequate irrigation facilities	3966	49.58	2

problems which influence the rapeseed and mustard production. It was reported that weeds posed a serious problem to rapeseed and mustard production. According to Garratt's rank technique, problem of weeds (like Gullidanda, Bathu and Jaundhar) was at the top rank. The constraint related to water for irrigation was accorded second rank by the producers of rapeseed and mustard. The third rank was given to high interest on credit. The rapeseed and mustard growers were found dependent on private money lenders and other sources as compared to institutional credit. The time consuming and complicated process of obtaining credit from financial institutions declined grower's interest and they opt for the private money lenders for loan even if they charge exorbitant interest rate. The fourth rank was given to non-availability of good quality plant protection chemicals followed by incidence of insect pest attack, high input cost and untimely availability, shortage & high cost of labour and non-availability of suitable varieties were given fourth, fifth, sixth, seventh and eighth ranks respectively.

#### **Suggestions for improving production and productivity of rapeseed and mustard**

Among the suggestions forwarded by the sampled farmers for improving production and productivity of rapeseed mustard, the most strongly suggested factor is the requirement of high yielding varieties of this crop. The second strongly suggested factor is that farmers' wish to get themselves trained in workshops arranged by state agriculture departments. No doubt, this is quite appreciable as it reflects farmers' inclination towards adopting modern farming techniques given appropriate training and support. This suggestion according to importance is followed by the factor which is linked to availability of labour in the agricultural labour market. A large number of farms complained about unavailability of agricultural labour during sowing and harvesting which hamper normal farming time schedule. Besides, timely availability of quality inputs particularly plant protection chemicals, better market infrastructure, better output prices were some of the important suggestions for improving production and productivity of rapeseed mustard in the study area.

#### **CONCLUSIONS & POLICY IMPLICATIONS**

It was concluded that rapeseed and mustard is an important oilseeds crop cultivated in Punjab state. The area under this crop was 30 thousand hectares with the production of 39 thousand metric tonnes in 2013-14. Bathinda district is one of the major rapeseed and mustard growing districts in the state. Overall total fixed cost was to the tune of ₹7125.72 per acre. On an average, the total cost of production of rapeseed and mustard was estimated to be ₹14525.62. The variable cost in case of small farmers was found more as it was ₹7612.87 followed by medium (₹7311.01) and large (₹7138.11). On an average per quintal total cost of output was estimated to be ₹2718.34 and profit margin came out to be ₹1094.16 (28.70 per cent). On small, medium and large farms the profit margin was 24.03 per cent, 27.95 per cent and 46.76 per cent respectively. The results of productivity analysis showed that at overall the actual yield was found less than the yield of PAU recommended variety (PBR 357) by 3.50 quintal per acre. This gap could be narrowed down by making available better quality farm inputs, control of pesticides and insecticides, weed control and disease management. The study brought out that the most common problems perceived by the sampled respondents were infestation of weeds, inadequate irrigation facilities, non-availability of good quality plant protection chemicals, shortage and high cost of labour etc. during the production of produce.

The results of this study have important policy implications:

- Farmers should be persuaded to explore the option of replacing less-remunerative crops with rapeseed mustard crop which may be more profitable. The cultivators may be unaware of the profit potential of this crop or may be bound by tradition in continuing the cultivation of less-remunerative crops. Generating awareness among the farmers about the oilseed crop options available to them is required to bring about the desired change in cropping pattern which will help in diversification of agriculture in the state along with reducing imports and saving foreign exchange.

- Major avenues for future increase in rapeseed and mustard production are expected to come from enhancement in productivity of this crop. To realize this expectation, a proper mix of technologies and strategies needs to be put in place. Given the difficulties involved in increasing the area under crop, a combination of land saving technologies involving high yielding varieties and hybrids and efficient crop management need to be adopted.
- Custom hiring of machinery should be arranged by cooperatives/non-government agencies to help the farmers.
- The establishment of new processing plants in or around mustard growing pockets in the district would sizably cut down transportation cost.
- Farmers should be encouraged to organize themselves into cooperatives which will help them improve the bargaining power and also generates scale economies in acquisition of

inputs, services and information.

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## Analysis of Growth, Instability, Modelling and Forecasting of Cotton Production Scenario in India

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### ABSTRACT

Cotton (*Gossypium* sp.), one of the most important commercial crops, has experienced a series of development since independence. The present study is an attempt to study different phase of development, the nature of development, its instability and forecast its future behaviour with the help of the different descriptive statistics. The present study has attempted to examine the nature and growth during pre, early, late hybrid and Bt cotton periods. Coefficient of variations along with instability index by Chand and Raju and also Coppock's index are provided similar instability results over the periods of cotton development. In between the spline regression technique and structural time series modelling technique, the spline model is found to be better and hence used for forecasting purpose. Forecasting figures up to 2017 reveals that cotton production in India will remain increasing and will reach to production of 56.65 million bales from 14.7 million hectare of land with an average yield of only 630 kg/ha during 2017. Productivity will remain far below either the average world productivity or the highest productivity in the world. As such the study strongly advocates for researchers towards technological breakthrough in cotton production in India

### Keywords

Forecasting, growth, instability, spline, structural time series model, technology

### JEL Codes

C53, C81, Q01, Q11, Q18

### INTRODUCTION

Cotton is one of the most important commercial crops in India. It has assumed social/political and economic significance in Indian economy due to its sheer contribution towards employment generation, foreign exchange earnings vis-a-vis national income. Cotton crop provides employment to 60 million people and 200 man days/ha (CAB, 2008). As on 2009-10, the cotton textile industry contributed to the extent of four per cent to the GDP, 14 per cent of industrial production and 14.2 per cent of export earnings (Anonymous, 2011).

In early sixties, cotton yield was very low due to domination of low yielding *desi* cotton varieties (*Gossypium arborerium* and *Gossypium herbaceum*) followed by American cotton (*Gossypium hirsutum*) varieties. These low yielding varieties were gradually replaced by hybrids since their introduction in late sixties. Cotton production increased significantly, associated with widespread application of input factors like fertiliser, pesticides and replacement of varieties. During passage of time, hybrid cotton was found susceptible to American

bollworm (*Helicoverpa armigera*); as a result it exhibited signs of yield plateauing during nineties. With the introduction of Bt cotton, resistance to cotton bollworm, cotton yield increased over the yield of 2001. As a reflection of growing acceptance of *Bt*, productivity of cotton continued to increase since 2002. India became one of the largest exporters, shipping 5.5 million bales during 2010-11, second only to USA (FAOSTAT, 2014). In 2010-11, the country touched a record production of 325 lakh bales with an average productivity of 496 kg/ha (Anonymous, 2011). Technological changes had significant effect on growth and stability of cotton cultivation. As a result cotton production in India has experienced large variations over the years since 1951. So the study of growth and instability in cotton got greater emphasis in research arena. In this context, the work of Narala & Reddy (2012) on instability in cotton, Suresh *et al.* (2013) on cotton are a few to mention. According to Chand and Raju (2008), instability in farm production has impact on supply and farm. Cotton is a crop that underwent continuous technology and policy shifts over

period of time. Keeping in mind the importance of cash crop like cotton on Indian economy coupled with the knowledge of transformation of production scenario, it is of most of importance to analyze the past production behavior of cotton so as to enable or foresee the likely production behavior of cotton in days to come. As such, the present study was undertaken to examine and compare the performance of cotton during different phases of its development, study of instability, model the production behavior and forecast the likely values of cotton production parameters in future.

**MATERIAL AND METHODS**

The present study is based on the secondary time series data from 1951 to 2012 on area, production and yield of India obtained by Ministry of Agriculture, Government of India.

Cotton production in India has experienced technological changes during a period of more than 60 years and results in short term and long term effects on the production processes. By and large, the cotton production scenario in India could be divided into 4 different period viz., pre hybrid period (1951-1970), early hybrid period (1971-1990) late hybrid period (1991-2001) along with whole period (1951-2012) and are used for data analysis. Presence of outlier are investigated by Grubb's statistic ([www.graphpad.com](http://www.graphpad.com)) and on presence outliers are replaced by median. Randomness is tested using turning point test and analysis of variance was also taken up to justify the division of whole period into four different sub periods. The most widely used descriptive measure of central tendency and dispersions like arithmetic mean, range, standard deviation along with simple and compound growth rate are used to describe the basic features of each series.

Cotton has undergone lot of improvement over last four decades, causing variability in growth during different phases. This variability in different growth period along with whole period is studied using Instability. In literature there are different methods of measuring instability under different situations, for the present work instability analysis was carried and most important and commonly used index to measure instability are used in this study, which are 1. Coefficient of variation (CV), 2. Coppock's instability index (CII per cent) and Instability index by Chand & Raju (2009).

After studying instability, the forecast models are developed using Spline analysis Hyndman *et al.* (2005), Simonoff (1996)) and structural time series modelling (Harvey, 1996). The models are developed using data from 1951 to 2011 is used and 2012 is used for model validation. Both the methods were compared and the statistically most suited model was selected based on lower values of RMSE, MSE, MAPE and MAE. Cotton forecast was validated for 2012 years data using best fitted model and generated forecast for next five years.

**RESULTS AND DISCUSSION**

Table 1 presents the results of outlier and randomness

test. In case of cotton production outlier was detected and was replaced by median of the respective series before further analysis. It is also clear from the Table 1 that the series under consideration have not followed definite trends in all the selected parameters. Results of ANOVA presented in Table 2 and 3 clearly justify the sub divisions of the whole period under study into different era of cotton development. Thus, it would be pertinent to examine, analyse and discuss the progress of cotton development in these periods separately.

Area under cotton in India has varied between 5.88 million hectare to 8.37 million hectare with an average of 7.59 million hectare (Table 4), registering a growth of almost 1.57 per cent per annum in pre hybrid period (1951-1970). The value of skewness (-1.41) indicates that there has been shift of area in favour of cotton during the later phase of pre hybrid era. If we compare the area under cotton in pre-hybrid period with that of the early hybrid period, it can be seen that virtually there has been no change in area (with a meagre annual growth rates of only 0.05 per cent, the lowest among all periods); as a result most probably the introduction of hybrid variety was the best options towards increasing cotton production during those days. In late hybrid period cotton cultivation expanded to as high as 9.34 million hectare with an average 8.31 million hectare. Both the skewness and kurtosis values for the period were negative, indicating that there has been expansion in area during latter half of this period and it remains steady throughout. Even then the productions could not be sustained with the higher

**Table 1: Test of outliers and randomness for area, production and yield of cotton in India**

Particulars	Area	Production	Yield
No. of observation	61	61	61
No. of point (p)	33	34	33
E (P)	39.33	39.33	39.33
V(P)	10.52	10.52	10.52
τ-cal	1.95	1.64	1.95
Inference	Random	Random	Random
Outlier	No	Yes	No

**Table 2: Analysis of variance for sub division of time periods**

Source of variation	Sum of squares	df	Mean square	F	Sig
<b>Area</b>					
Treatment	21.13	3	7.04	11.90	0.00
Error	34.34	58	0.59		
<b>Production</b>					
Treatment	2022.49	3	674.16	48.10	0.00
Error	812.88	58	14.01		
<b>Yield</b>					
Treatment	522639.28	3	174213.10	69.27	0.00
Error	145863.42	58	2514.88		

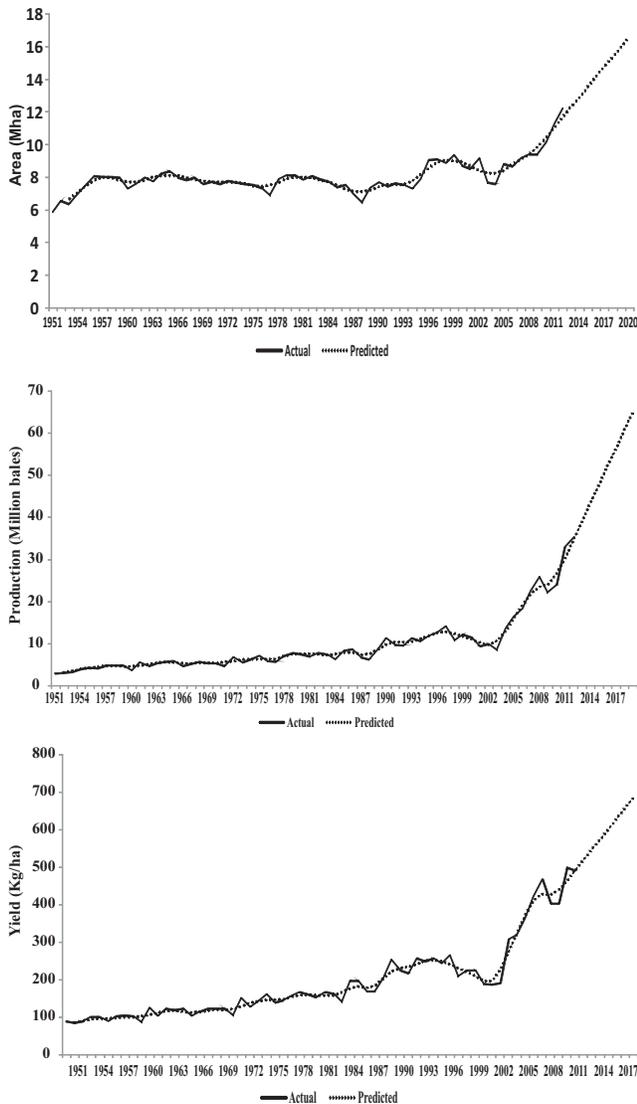
**Table 3: Multiple comparison for different time period**

Particulars	Period	Area (million hectare)			Production (million bales)			Yield (Kg/ha)		
		MD (I-J)	SE	Sig.	MD (I-J)	SE	Sig.	MD (I-J)	SE	Sig.
BtP	EHP	1.517*	0.289	0.000	13.681*	1.405	0.000	205.050*	18.825	0.000
	LHP	.774*	0.328	0.022	9.583*	1.596	0.000	135.454*	21.383	0.000
	PHP	1.499*	0.289	0.000	16.158*	1.405	0.000	261.750*	18.825	0.000
EHP	BtP	-1.517*	0.289	0.000	-13.681*	1.405	0.000	-205.050*	18.825	0.000
	LHP	-.742*	0.289	0.013	-4.097*	1.405	0.005	-69.595*	18.825	0.000
	PHP	-0.018	0.243	0.941	2.477*	1.184	0.041	56.700*	15.858	0.001
LHP	BtP	-.774*	0.328	0.022	-9.583*	1.596	0.000	-135.454*	21.383	0.000
	EHP	.742*	0.289	0.013	4.097*	1.405	0.005	69.595*	18.825	0.000
	PHP	.7247*	0.289	0.015	6.574*	1.405	0.000	126.295*	18.825	0.000
PHP	BtP	-1.499*	0.289	0.000	-16.158*	1.405	0.000	-261.750*	18.825	0.000
	EHP	0.018	0.243	0.941	-2.477*	1.184	0.041	-56.700*	15.858	0.001
	LHP	-.724*	0.289	0.015	-6.574*	1.405	0.000	-126.295*	18.825	0.000

*BtP: Bt Period, EHP: Early Hybrid Period, LHP: Late Hybrid Period, PHP: Pre Hybrid Period, MD: Mean Difference, SE: Standard Error, Sig: Significance Level*

**Table 4: Per se performance of cotton production in India**

Particulars	Area (Million hectare)				
	Pre hybrid (1951-1970)	Early Hybrid (1971-90)	late Hybrid (1991-01)	Bt cotton (2002-12)	Whole Period (1951-2012)
Mean	7.59	7.57	8.31	9.09	7.98
Maximum	8.37	8.13	9.34	12.18	12.18
Minimum	5.88	6.46	7.32	7.6	5.88
SD	0.66	0.42	0.76	1.3	0.95
Kurtosis	1.36	1.27	-1.88	2.49	5.46
Skewness	-1.41	-1.07	-0.06	1.25	1.47
SGR per cent	1.57	0.05	1.33	3.04	1.73
CGR per cent	2.51	0.41	2.18	2.39	2.51
<b>Production (Million bales)</b>					
Mean	4.78	7.25	11.35	20.93	9.61
Maximum	6.01	11.42	14.23	35.2	35.2
Minimum	3.04	4.76	9.52	8.62	3.04
SD	0.9	1.44	1.44	8.59	6.82
Kurtosis	-0.75	2.64	0.04	-0.67	4.55
Skewness	-0.6	1.09	0.57	0.22	2.11
SGR per cent	4.14	7.12	-0.3	22.94	17.06
CGR per cent	4.76	3.11	0.87	13.87	4.76
<b>Yield (kg/ha)</b>					
Mean	106.25	162.95	232.55	368	193.39
Maximum	125	252	265	499	499
Minimum	85	106	190	186	85
SD	14.1	31.24	23.42	108.66	104.69
Kurtosis	-1.41	2.6	-0.73	-0.58	1.59
Skewness	-0.13	1.08	-0.28	-0.63	1.46
SGR per cent	1.93	6.89	-1.41	14.91	7.39
CGR per cent	2.21	2.71	-1.29	9.76	2.21



**Figure 1: Observed and forecasted area production and yield of cotton in India**

yield potentiality of hybrid cottons compared to the previous period. In Bt cotton period i.e. from 2002 onwards cotton cultivation shown spurt in area with average 9.09 million hectare and also registered highest growth rate of 3.04 per cent with positive skewness which clearly point out that genetically modified cotton was widely accepted by farmers from the beginning of the Bt cotton era. A clear reflection of the growth and changing behaviour during the above periods is noticed while analysing the information for whole periods under consideration; on average cotton was grown on 7.98 million hectare area with annual growth rate of 1.73 per cent per annum.

So far about the productions of cotton during pre-hybrid era (1951-1970) is concerned, an average production of 4.78 million bales associate with a growth of almost 4.14 per cent per annum is recorded. Negative skewness and kurtosis indicates that steady changes in

production have taken place, commensuration with the changes in area, during the latter half of the pre hybrid era. In early hybrid period (1971-1990) with the introduction of hybrids cotton, production has increased by about 65 per cent compared to the previous period. Introduction of hybrid varieties have made significant improvement at the very beginning of the early hybrid period as evident from the positive value of skewness (1.09) and emphatically proves the superiority of hybrid cotton technology over desi or traditional cotton varieties. In late hybrid period (1991-2001) cotton production was reached to almost 3 times higher as compared to the pre hybrid period, mainly because of higher yield potentiality of hybrid seeds. But the tempo of such higher production could not be sustained; the production started declining during the latter part of the late hybrid period. This is clearly evident from the negative simple growth rate and the lowest ever compound growth rate of production during this period. One of the reasons for such non sustenance in cotton production may be attributed to the susceptibility of hybrid cotton varieties towards cotton bollworm (*Helicoverpa armigera*). So there was a need to have breakthrough in management of cotton crop. As a result Bt cotton was introduced as one of the crop management techniques to increase cotton production; beginning of the Bt cotton era. With the introductions of Bt cotton, cotton production in India undergone metamorphic changes as evident from the doubling of average production (20.93 million bales) over the previous late hybrid period (11.35 million bales). Nobody can deny the contribution of a marginal change in area, from 8.31 million hectare to 9.09 million hectare over the late hybrid period. While looking at the figures for skewness, kurtosis, simple growth rate and compound growth rate, it could be noticed that during this period the production potential has been maintained with highest ever growth rates. Thus combining all the periods, it could be inferred that cotton productions in India has passed through a positive changes all through. This is also evident from the 17.06 per cent and 4.76 per cent simple and compound growth rates respectively during whole period under study (1951-2012).

The journey of cotton production in India during the study period started with only 88 kg/ha in 1951, during the passage of time it has gone through a sea change in the form of pre, early, late hybrid era and ultimately has reached to the Bt cotton era. As a result the productivity has reached to 499kg/ha. Among the different periods under study the present era of Bt cotton has recorded maximum simple (14.91 per cent) as well as compound growth rate of 9.76 per cent in per hectare yield. By and large the productivity of cotton has recorded a 2.21 per cent compound growth rate during the whole period under study. In spite of all these developments in area, per hectare yield and production of cotton in India, the productivity is far below the highest productivity of cotton in the world (Brazil, 2027kg/ha (Anonymous,

2011) and also average productivity of world of 739 kg/ha (Anonymous, 2010) Under the given present resource crunch situation, particularly the land and water resources, India must put emphasis on increasing the yield potential without hampering the environmental sustainability.

**Instability analysis**

Instability was calculated using three indices as discussed in material and methods and the results are presented in Table 5. By and large, there has been uniformity in results of instability measured using all the three methods. Area under cotton productions has recorded maximum instability during Bt cotton period, so also for production and productivity for all the methods. Among the other three periods i.e. pre hybrid, early hybrid and late hybrid instabilities in production and productivity are recorded least during late hybrid period where as comparatively lesser instabilities is recorded during pre-hybrid period for area under cotton. This result is well commensurating with the growth rates in productions and productivity of cotton during late hybrid periods. The productions and productivity were almost at stagnant conditions, particularly during the latter part of the late hybrid periods. Higher instability in area during late hybrid period may be attributed to negative skewness and positive growth rates in area under cotton during late hybrid period. Thus, from the study of instability it can be inferred that the changes in area, resulting in higher instability has provided better fruit during Bt cotton period.

**Modelling and forecasting of cotton**

Having knowledge on the past performance of cotton production in India, it is imperative to predict the future production behaviour of this crop using semi parametric spline regression and structural time series modelling technique.

Spline is semi parametric regression technique having several advantages over local polynomial regression. It is designed to prevent over fitting, a prominent concern with nonparametric regressors. Best fitted models for the both methods namely spline regression through cross validation and structural time series analysis were identified based on maximum R square value, minimum RMSE, MPE and MAPE in respective cases. The results of spline regression technique, using the cross-validation method, presented in Table 6 reveals that for the area under cotton, optimum bandwidth is 0.000012 with 60.39degrees of freedom is the best fitted model. For production optimum bandwidth was calculated as 0.00024 with 52.45degrees of freedom. Calculated value for optimum bandwidth for cotton productivity was 0.000948 with 42.43 degrees of freedom. Results of structural time series model are presented in Table 7. In case of area, production and yield of cotton both level and shift were found significant. Thus area, production and productivity in India are expected to increase significantly. In between the selected spline regression and structural time series model for each and every series, it is found that spline regression model outperforms the

**Table 5: Instability analysis of cotton production in India**

Particulars	Instability index (per cent)	Pre hybrid (1951-1970)	Early hybrid (1971-1990)	Late hybrid (1991-2001)	Bt period (2002-2012)	whole period (1951-2012)
Area (Million)	Chand and Raju	5.34	5.81	6.09	18.73	8.88
	CV	8.69	5.60	9.10	14.33	11.96
	Coppock's	10.57	10.58	10.62	11.95	10.93
Production	Chand and Raju	15.48	18.57	14.37	18.79	16.95
	CV	18.93	19.84	12.68	41.02	70.96
	Coppock's	11.67	12.12	11.46	12.34	11.89
Yield (kg/ha)	Chand and Raju	13.72	15.44	12.28	16.70	14.61
	CV	13.27	19.17	10.07	29.53	54.13
	Coppock's	11.44	11.78	11.26	12.06	11.59

**Table 6: Modeling of area, production, yield of Indian cotton using spline regression**

Modeling of area, production, yield of Indian cotton using spline regression						
Particulars	R <sup>2</sup>	λ	TrA (df)	RMSE	MPE	MAPE
Area	0.99	0.000012	60.39	0.21	-0.08	2.04
Production	0.99	0.00024	52.45	0.76	0.47	5.49
Yield	0.99	0.000948	42.43	13.01	0.22	4.77
Modeling of area, production, yield of Indian cotton using structural time series						
Particulars	R <sup>2</sup>	Level	Slope	RMSE	MPE	MAPE
Area	0.94	10.39***	0.61**	0.19	5.39	1.88
Production	0.98	30.74***	4.31***	0.75	22.02	5.70
Yield	0.98	464.33***	24.22***	12.97	22.08	4.75

\*\*\* and \*\* Significant at one and five per cent level

**Table 7: Modeling of area, production, yield of Indian cotton using structural time series**

Particulars	R <sup>2</sup>	Level	Slope	RMSE	MPE	MAPE
Area	0.94	10.39***	0.61**	0.19	5.39	1.88
Production	0.98	30.74***	4.31***	0.75	22.02	5.70
Yield	0.98	464.33***	24.22***	12.97	22.08	4.75

\*\*\* and \*\* Significant at one and five per cent level

**Table 8: Forecasted values for area, production, yield of cotton using spline regression in India**

Year	Area (Million ha)		Production (Million bales)		Yield (kg/ha)	
	Actual	Forecast	Actual	Forecast	Actual	Forecast
2012	12.180	11.62	35.200	34.935	498.286	490.291
2013		12.24		39.279		518.285
2014		12.86		43.623		546.279
2015		13.48		47.967		574.273
2016		14.10		52.312		602.267
2017		14.73		56.656		630.261

structural time series model, as evident from lower values of RMSE, MPE and MAPE. Therefore in this study spline regression model has been used for forecasting purpose.

Forecasting was done using spline regression and forecasted values for the next five years are provided in Table 8. It is clear that the forecasted values for area, production and yield are well in conformity with actual values. It is forecasted that in 2017 India is supposed to produce 56.65 million bales of cotton with productivity of 630 kg/ha from 14.73 million hectare area (Table 8). Though India is forecasted to increase in productivity in 2020 but still it will lower than world's 2009 average productivity of 739kg/ha. Bt cotton cultivation increased yield and, thereby, increased profit by reducing the plant protection cost but cost of cultivation also increased. Bt cotton requires more inputs in terms of fertilizers and irrigation, and is particularly susceptible to rainfall shortage at peak bolling period. In India only 35 per cent of total area of cotton is under irrigation and rest is still rainfed (Suresh *et al.*, 2013). Also regarding pest protection, scientific studies and the company statements show that the target pest bollworm has developed tolerance to Bt cotton, whereas secondary pests like mealy bugs and whiteflies which were hitherto unseen are causing major damage (Kalamakar, 2013). These factors are affecting cotton cultivation in India. In 2009-10, 71per cent of total area was under Bt cotton and remaining under non Bt cotton and may be one factor of lower productivity in India (Suresh *et al.*, 2013).

**CONCLUSIONS**

From the above analysis, several silent findings can be noted. Firstly, the cotton production in India has undergone growth variations in different time phases; in each and every phase, there has been improvement over respective previous period. Though maximum growth is observed in Bt cotton period, it is highly instable. Although the cotton production and productivity is following increasing trends, these are much lower than world productivity. India supposed to produce 56.65 million bales of cotton with productivity of

630 kg/ha from 14.73 million hectare area during 2017 but will remain far below the corresponding figure of whole world or world's highest productivity. Hence further researches are needed to augment the productivity vis-à-vis production of cotton; yet another technological breakthrough is needed.

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## Export Competency of Indian Spice Industry

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### ABSTRACT

The present investigation tries to assess the trends in export of spices of India and its export competitiveness in global framework. The study is based on secondary data for the period 2008 to 2015. The Simpson Diversity Index (SDI) is used to measure the export diversity, whereas the Revealed Symmetric Comparative Advantage (RSCA) ratio assessed the comparative advantage of Indian spice industry in the international market. The degree of reliance of domestic producers of the importing countries on foreign markets is derived from Export Propensity Index (EPI). The findings are presented in the form of tables and graphs.

### Keywords

Comparative advantage, diversity, export competitiveness, export trends, growth, import

### JEL Codes

F18, F10, F19, F01, F00

### INTRODUCTION

India is known as the land of spices and boasts of a long history of trading with the ancient civilizations of Rome and China. Today Indian spices are the most sought after globally, given their requisite aroma, texture, taste and medicinal value. Traditionally spices in India have been grown in small land holdings, with organic farming gaining prominence in recent times. In reality almost all the states and union territories of India grow one or the other spices. India is the world's largest producer, consumer and exporter of spices. Out of 109 spices listed by ISO (International Standards Organization), India produces around 75 spices in its various climatic regions. The world in the recent years has witnessed many changes in terms of economy, culture and social life of the people. This has led to the change in food habits of the people. People have moved towards ready to cook, ready to eat and fast foods. Change in food habits has led to change the spice consumption. India has near monopoly in spice oils and oleoresins and Indian spices have obtained geographical indicators such as Malabar pepper, Alleppey Green Cardamom, Coorg Green Cardamom and Naga chilli.

#### Area and Production of Spices

The varying climatic conditions in India from tropical

to sub-tropical to temperate-offer enormous scope for cultivation of spices, with majority of Indian states producing several spices. Almost all Indian states produce spices, with the total area under spice cultivation pegged at around 3.14 million hectares. Top spices produced in the country include pepper, cardamom, chilli, ginger, turmeric, coriander, cumin, celery, fennel, fenugreek, ajwain, dill seed, garlic, tamarind, clove, and nutmeg. In 2013-14, about 3.14 million hectares were used to cultivate spices, with an estimated production of 5.83 million tonnes which is estimated to reach 3.19 million hectares and 6.18 million tonnes by 2015-16 (Indiastat.com). Andhra Pradesh, Gujarat, Rajasthan, Karnataka, Madhya Pradesh, Tamil Nadu, Assam and west Bengal were the top producers. The estimated area as in 2014-15 is more in Rajasthan (866868 ha) followed by Gujarat (473822 ha) and production is more in Gujarat (1014470 million tonnes) followed by Andhra Pradesh (918018 million tonnes), Rajasthan (618309 million tonnes). India is also the largest domestic market for spices in the world. It is significant to note that only 5 to 10 per cent of the total production is exported and the rest is consumed domestically.

#### Review of Export performance of Spices

India commands a formidable position in the world

spice trade with the spice exports expected to touch US\$ 3 billion by 2016-17. India is the biggest exporter of spices. About 893920 tonnes of spices, valued at US \$ 2440.8 million, were exported in 2014-15. In value terms, India's spice market grew an average 8.8 per cent annually between 2009-10 and 2014-15 (Lamba *et al.*, 2015). Export of spices from India has increased substantially in volume (10 per cent) and value (17 per cent) terms in the last 10 years and is expected to touch US\$ 3 billion by 2016-17. In the last few years, exports of value added spices (like oils / oleoresin) have increased significantly in both volume terms (15 per cent) and value terms (18 per cent). During 2015-16, a total of 8, 43,255 tons of spices and spice products valued ₹16238.23 crore (US\$2482.83 Million) have been exported from the Country as against 8, 93,920 tons valued ₹14899.68 crore (US\$ 2432.84 Million) in 2014-15, registering an increase of 9 per cent in rupee terms and 2 per cent in dollar terms of value (Spices Handbook, 2016). Increase in Chilli, Pepper, and Small cardamom, Fenugreek, Oils and Oleoresins exports in both volume and value terms contributed substantially. In 2014-15, US was the major importer, followed by China, Vietnam, the UAE, Malaysia, the UK, Germany, Saudi Arabia, Thailand and Sri Lanka. Spice exports to the US increased 4.3 per cent to US\$ 410.3 million in 2014-15 from US\$ 393.3 million in 2013-14 (Lamba *et al.*, 2015). The spice export basket consists of whole spices, organic, spice mixes, spice blends, freeze dried, curry powders/mixtures, oleoresins, extracts, essential oils, dehydrated, spice in brine, and other value added products.

The Spices Board of India works towards the development and worldwide promotion of Indian spices. It provides quality control and certification, registers exporters, documents trade information and provides inputs to the central government on policy matter. The Spices Board's programme to enhance the production and productivity in cardamom and black pepper is also being given a fillip.

The aim of the study is to analyse the competitive status of India among spice producing countries. Recognizing an importance of spice crops and its value added products in foreign exchange earnings, the present study "Export Competency of Indian spice Industry" was undertaken with the following objectives:

- i. to examine the trends in export of spices of India and
- ii. to access export competitiveness of Indian spices in global framework.

## MATERIALS AND METHODS

### Collection of Data

The study was conducted on the basis of secondary data available on the spice production, area and export from India with respect to world production. The research approach is descriptive. The data regarding area, production and export of spices were collected from web portals of Spice Board, FAO, and Indiastat.com.

### Analysis of Data

The data analyzed by adopting Compound Annual

Growth Rate, Revealed Comparative Advantage, Export Propensity Index and Import Penetration Index.

Compound Annual Growth Rate (CAGR) was used to study the status of area, production and export of spices from India and calculated by the formula:

$$CAGR = [(Current\ Value/Starting\ Value)^{1/n} - 1] * 100$$

To study the changes in the composition of the India's spice export basket over time, relevant data on quantity and value of every spice export in two different period i.e. 2008-09 and 2015-16 were worked out. The Simpson Diversity Index was used for measuring the extent of the export diversification of spices. Saran *et al.* (2013) has used for measuring the extent of the export diversification of poultry products. The SDI takes into account the number of items exported, as well as the quantity of each of the exported item. It varies from 0 to 1. The value of 1 indicates a total diversification, whereas the value of 0 indicates a perfect concentration of trade towards a particular product in the particular period.

$$SDI = n(n-1)/N(N-1)$$

Where,

n = Quantity or Value of export of Individual spice in a period

N = Total quantity or value of export in a period

Market identification for spice commodities was done by examining the comparative advantage of Indian spice industry, Revealed Symmetric Comparative Advantage (RSCA) index was calculated using the formula:  $RSCA = (RCA-1) / (RCA+1)$  which measures the comparative advantage or disadvantage of a country with respect to another country or group of countries.

RCA that is the Revealed Comparative Advantage was calculated by the following relation:

$$RCA = \frac{\text{India's Export of Spices to the world} / \text{India's total Export of Agri commodities}}{\text{Total of World Export of Spices} / \text{Total World Export of Agri commodities}}$$

The degree of reliance of domestic producers of the importing countries on foreign markets was derived from Export Propensity Index (EPI):

EPI = Export from India to Jth Country / GDP of Jth country \* 100

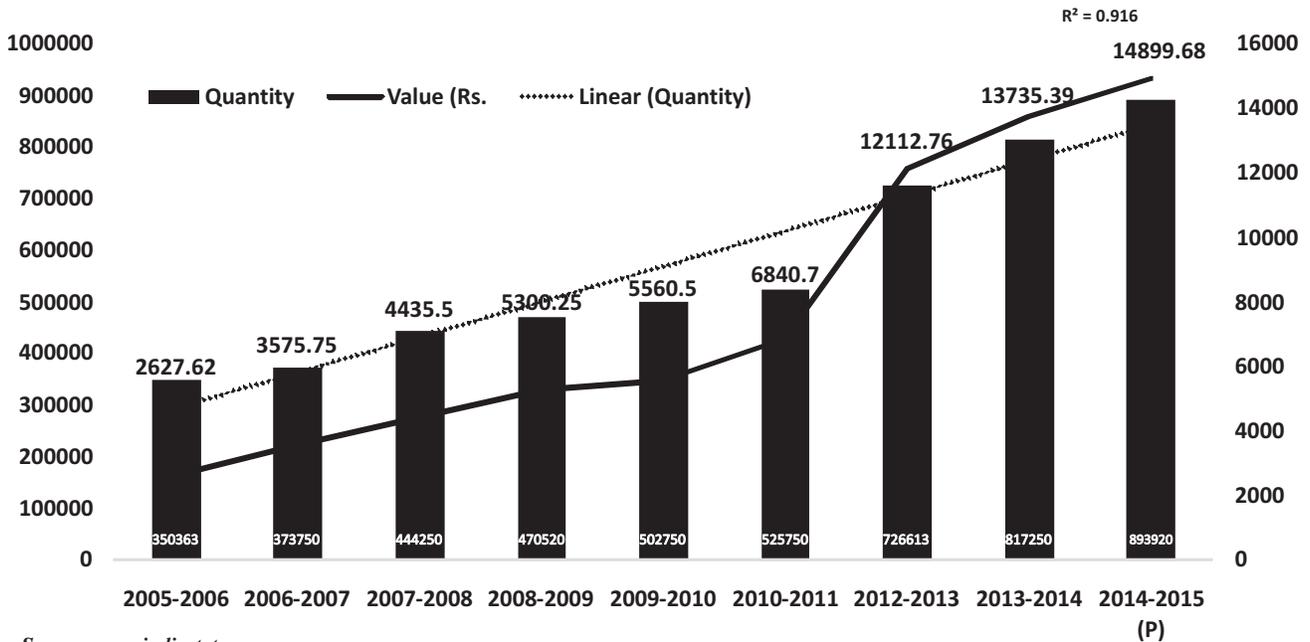
The extent to which the domestic demand of jth country is satisfied by imports was demonstrated by using Import Penetration Index formula as given below:

IPI = Import of Jth country / GDP of Jth country - Net exports of Jth Country \* 100

## RESULTS AND DISCUSSION

Spice export basket of India showed increasing trend over the years. The exports of spices grew at a CAGR of 10.96 and 21.10 percent in quantity and value terms respectively from 2005-06 to 2014-15. The coefficient of determination (R<sup>2</sup>) value obtained for value of exports i.e. 0.9163 is close to unity which indicates that the spice

Figure 1: Trend of spice export from India



Source: www.indiastats.com

export of India is of very promising and helps to earn considerable foreign exchange through export of spice commodities. Export of spices from India was in line with trend line except in the year 2009-10 where the export was low due to the economic slowdown of world.

India primarily exports pepper, chilli, turmeric, ginger, cardamom, coriander, cumin, fennel, fenugreek, celery, nutmeg and mace, garlic, tamarind and vanilla. Processed spices such as spice oils and oleoresins, mint products, curry powder, spice powders, blends and seasonings were also exported. In 2014-15, chilli, cumin, turmeric, coriander and ginger accounted for almost 50 per cent of the total volume of spice exports. Processed spices, such as curry powder, mint products and spice oils and oleoresins, accounted for 34.1 per cent of total spice exports. Chilli accounted for the largest volume of the spice exports in 2014-15, with a 23.6 per cent share.

**Growth and Diversity in Indian Spice Export**

The compound growth rates of quantity and value of export of spices from 2008-09 to 2015-16 are presented in Table 1. It is revealed that there is a significant increase in the export quantity of Garlic that has registered a growth rate of 52 percent followed by cardamom (28 percent), ginger (22 percent) and other spices (10 percent) which includes tamarind, cassia, saffron and asafetida. Among various spices the cardamom large has registered a negative growth rate of -13 percent in the same period while there was no export of vanilla from India after 2011. In terms of value the highest growth was seen in Garlic (59 percent), followed by cardamom (32 percent) and Ginger (29 percent). Overall the Export of spices from India has increased substantially in volume (7.57 per cent)

and value (15.02 per cent) terms during the period. The table 4 also reveals the diversity in spice export both in quantity as well as in value terms. The Simpson diversity Index value for the quantity of spice exported that is close to 1 shows that the export of spices is well diversified over the wide range of spices exported but the SDI in 2015-16 was little lower than that in 2008-09 due to the exclusion of vanilla from spice exported in 2015-16. The SDI in value of spice exported indicated a rise in diversification from 0.84 in 2008-09 to 0.86 in 2015-16 which shows that the spice exports in value terms is becoming more diversified.

**Direction of India's spice exports**

In 2014-15, the US was the major importer, followed by China, Vietnam, the UAE, Malaysia, the UK, Germany, Saudi Arabia, Thailand and Sri Lanka. Spice exports to the US increased 4.3 percent to US \$ 410.3 million in 2014-15 from US \$ 393.3 million in 2013-14. Exports to China grew over 63.8 percent followed by UAE (39.3 percent) and Vietnam (19.8 percent).

The compound annual growth rate in exports directed towards the major importing countries during the period of 2008 to 2016 in value terms is shown in Table 2. Among these countries, Vietnam has seen the highest growth in spice import from India that is 64 percent during the period followed by Indonesia (37 percent) Mexico (24 percent) and China (23.4 percent). These countries arranged in descending order of their growth rate between the periods of 2008- 09 to 2014-15 is presented below in Table 2.

**Revealed comparative advantage**

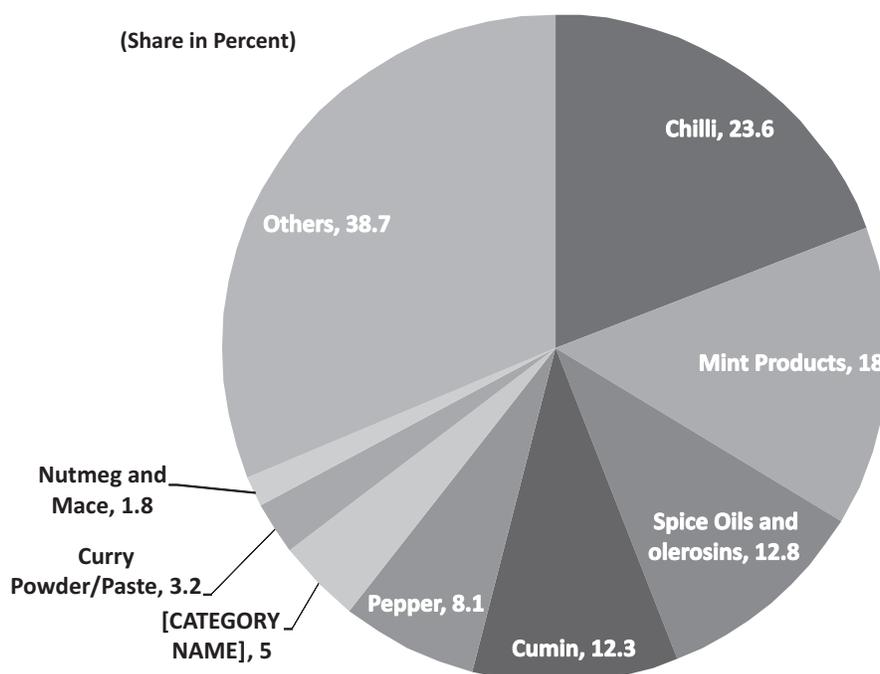
The revealed symmetric comparative advantage of

Table 1. Growth and Diversity in Spices Export from 2008-09 to 2015-16 (Qty. in MT)

Spices	Qty. in MT			Value in Lakhs		
	2008-09	2015-16	CAGR (per cent)	2008-09	2015-16	CAGR (per cent)
Chilli	188000	347500	7.98	108095	393170	17.52
Mint products (3)	20500	21150	0.39	142025	257759	7.73
Spice oils & oleoresins	6850	11635	6.85	72050	214255	14.59
Pepper	25250	28100	1.35	41373.5	173041.5	19.59
Cumin	52550	98700	8.20	54400	156699	14.14
Turmeric	52500	88500	6.75	24857.75	92165	17.80
Other spices (2)	20000	45500	10.82	10564	63413	25.11
Curry powders/paste	13250	26550	9.08	16375	53174.5	15.86
Cardamom (Small)	750	5500	28.28	4726.5	44982.75	32.53
Coriander	30200	40100	3.61	20378.75	42680.5	9.68
Ginger	5000	24800	22.16	3482.5	27062	29.21
Fenugreek	20750	33300	6.09	7175.25	23380	15.91
Nutmeg & mace	2155	4050	8.21	6074.75	20928.25	16.72
Fennel	8675	15320	7.37	4315	17239.6	18.90
Other seeds (1)	17500	23650	3.84	6498.5	16121	12.03
Garlic	760	22500	52.73	350.25	14642.5	59.46
Cardamom (Large)	1875	600	-13.28	2280.75	7332.5	15.7
Celery	3650	5800	5.96	2333	5776.5	12.00
Vanilla	305	0	0.00	2670	0	0.00
Total	470520	843255	7.57	530025.5	1623822.6	15.02
<b>Simpson diversity index</b>	<b>0.799</b>	<b>0.793</b>		<b>0.845</b>	<b>0.869</b>	

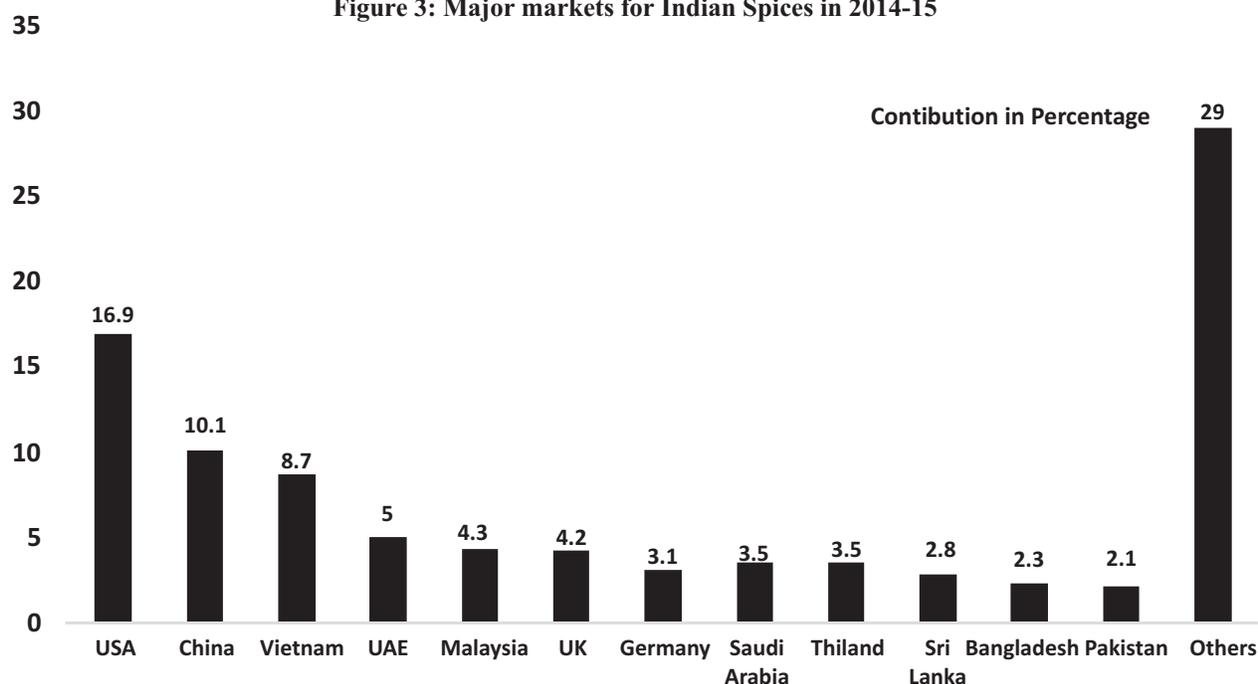
Source- Indiastat.com

Figure 2: Share of Major spices in India's major spices exports during 2014-15



Source: Spice Board of India

Figure 3: Major markets for Indian Spices in 2014-15



Source: Spice Board of India

Table 2: Growth in India's spice exports

Country	(Qty. in lakhs)		CAGR (percent)	Ranking
	2008-09	2014-15		
Vietnam	4012.26	128142.2	64.02	1
Indonesia	7715.46	72104.24	37.61	2
Mexico	4847.24	21850.57	24.00	3
China	33768.05	147442.9	23.44	4
U.S.A	112441.5	270464	13.36	5
Netherlands	11356.54	26964.98	13.15	6
U.K	24164.76	56354.45	12.86	7
Germany	20532.96	44959.52	11.85	8
U.A.E	33803.33	73823.41	11.81	9
Sri Lanka	22626.01	47157.38	11.06	10
Malaysia	36172.06	69089.6	9.69	11
Singapore	21914.14	29233.14	4.20	12
Other Countries	196670.7	502381.7	14.34	
Total spices export	530025	1489968	15.91	

India in export of total spice over last four years had shown in Table 3. Revealed symmetric comparative advantage during the last year was 0.913. The values of revealed symmetric comparative advantage were close to unity which indicates that India has a revealed comparative advantage in the export of spice commodities. It is observed that the values of RSCA were showing a slight decrease over the years.

#### Export Propensity Index

The export Propensity Index is the measure of the degree of reliance of domestic producers of the importing countries on foreign markets. The EPI was higher for Vietnam followed by Malaysia and Singapore. It indicates that high degree of reliance of domestic producers on foreign markets in those countries. These countries are good for existing players where the competition is high. The countries with low EPI such as Germany, United States of America and United Kingdom are good markets for new players because the competition is less in those nations. The EPI for spice is shown in Table 4.

Table 3: Revealed comparative advantage of India in spice export

Particulars	(Million US \$)			
	2014	2013	2012	2011
India's spice export	2267.67	2212.13	2037.76	1502.85
India's agriculture export	42921.77	37097.81	29994.24	18782.81
World spice export	43197.5	42370.12	45483.18	49344.43
World agriculture export	17917428.16	17939293.13	17398103.99	17689323.80
RCA	21.91	25.25	25.99	28.68
RCSA	0.913	0.924	0.926	0.933

Source: Data compiled from Spice board of India, FAOSTAT

**Table 4: Export propensity index for importing countries**

Country	Export (US\$ Million)	GDP(US\$ Million)	EPI
U.S.A	338.253	16,768,100	0.00201
China	322.616	9,240,270	0.00349
Vietnam	101.673	171,390	0.05932
Malaysia	78.959	313,159	0.02521
U.A.E	76.282	402,340	0.01895
U.K	74.583	2,678,455	0.00278
Germany	63.271	3,730,261	0.00169
Singapore	58.632	297,941	0.01967
Saudi Arabia	56.907	748,450	0.00760

Source: Data compiled from Spice board of India, FAOSTAT

### Import Penetration Index

The import penetration index is to measure the extent to which the domestic demand of Jth country is satisfied by imports. It is clear from Table 5 that IPI was high for Vietnam followed by Malaysia and Singapore. Which shows that domestic demand was satisfied by imports to a considerable extent. The low IPI are less reliable for exporting the spice commodities. The IPI of spice commodities is shown in the Table 5.

**Table 5: Import Penetration Index for importing countries**

Country	Imports (Million US\$)	Exports (Million US \$)	GDP (Million US \$)	IPI
U.S.A.	371.782	100.475	16,768,100	0.0022
China	352.616	471.888	9,240,270	0.0038
Vietnam	121.674	32.306	171,390	0.0710
Malaysia	102.385	45.017	313,159	0.0327
U.K.	200.986	70.822	2,678,455	0.0075
Germany	211.330	191.945	3,730,261	0.0057
Singapore	68.633	18.842	297,941	0.0230

Source: Data compiled from Spice board of India, FAOSTAT

### CONCLUSIONS

The spices sector plays a significant role in the development of Indian economy. Our growth in spices export is remarkable though not spectacular considering the historical importance of India as a land of spices. Indian spices flavor foods in over 130 countries and their intrinsic values make them distinctly superior in terms of taste, colour and fragrance. Presently, demand for value added spices like encapsulated spices; oils and oleoresin is high in the domestic as well as in the international markets. Spices are in a sweet spot with good demand and reasonably remunerative prices. With the reported use of spices oils and oleoresins in soft drinks, food and medicines demand for Indian spice oils and oleoresins is bound to shoot up. In terms of production too India has an upper edge, as no other country in the world produces as many spices as India does. India commands a

formidable position in the world spice trade with the spice exports expected to touch US\$ 3 billion by 2016-17. In value terms, India's spice market grew an average 8.8 per cent annually between 2009-10 and 2014-15 (up to December 2014). Total spices export from India stood at 893920 tonnes valued at US \$ 2440.8 million in in 2014-15. India primarily exports pepper, chilli, turmeric, ginger, cardamom, garlic and processed spices such as spice oils and oleoresins, mint products, curry powder, were also exported. In 2014-15, chilli, cumin, turmeric, coriander and ginger accounted for almost 50 per cent of the total volume of spice exports. Processed spices, such as curry powder, mint products and spice oils and oleoresins, accounted for 34.1 per cent of total spice exports. Chilli accounted for the largest volume of the spice exports in 2014-15, with a 23.6 per cent share. In terms of value the highest growth was seen in Garlic (59 percent), followed by cardamom (32 percent) and Ginger (29 percent). Overall the Export of spices from India has increased substantially in volume (7.57 per cent) and value (15.02 per cent) terms during the period. The Simpson diversity Index value for the quantity of spice exported that is close to 1 shows that the export of spices is well diversified over the wide range of spices exported but the SDI in 2015-16 was little lower than that in 2008-09 due to the exclusion of vanilla from spice exported in 2015-16. The SDI in value of spice exported indicated a rise in diversification from 0.84 in 2008-09 to 0.86 in 2015-16 which shows that the spice exports in value terms is becoming more diversified. In 2014-15, the US was the major importer, followed by China, Vietnam, the UAE, Malaysia, the UK, Germany, Saudi Arabia, Thailand and Sri Lanka. Spice exports to the US increased 4.3 percent to US \$ 410.3 million in 2014-15 from US \$ 393.3 million in 2013-14. Exports to China grew over 63.8 per cent followed by UAE (39.3 per cent) and Vietnam (19.8 per cent). Export of spice commodities during last four years of 2011-2014 remained competent though slight decrease was observed over the years. The value of revealed comparative symmetric advantage remains close to unity which is an indicator of dominance of Indian spice industry. Export propensity index for Vietnam and Malaysia were the highest which shows that high degree of reliance of domestic producers on foreign markets in those countries. Import Penetration Index was also showing same trend where Vietnam and Malaysia had the highest value which shows that domestic demand is satisfied by imports to a considerable amount.

### RECOMMENDATIONS

- Export of spice commodities should get due attention with respect to countries like Vietnam, Malaysia and Singapore as they ranked top in terms of Export Propensity Index and Import Penetration Index.
- Export of value added spice products is of great importance and government should provide

schemes for setting up of small scale processing units and it should be in organized form.

- The safety standards advocated by countries are different in nature, setting up of Laboratory services with strict certification should be followed to avoid on board rejection by respective countries.

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## An Economic Analysis of Aromatic Rice in Balrampur District of Chhattisgarh

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### ABSTRACT

The present study is based on an economic analysis of production and marketing of aromatic rice with the following objectives: To work out the cost and returns of aromatic rice in the study area. The present study was conducted in Balrampur district of northern hills of Chhattisgarh. Out of six blocks of the district, three blocks, namely Balrampur, Shankargarh, and Kusmi were selected randomly for the study. A sample of one hundred fifty farmers was selected for the study. The primary data from the farmers has been collected through personal interview method with the help of well-designed schedule for the year 2014-15. The canal was observed as a major source of irrigation. The average cropping intensity was observed 137.24 percent. The average size of holding of aromatic rice growers was 2.25 hectares. On an average the cost of cultivation per hectare of Jeeraphool variety of aromatic rice were calculated at ₹35236.04. Among different cost items contribution of total labour cost was 54.85 percent to the total cost in the case of Jeeraphool variety of aromatic rice, which indicate that the contribution of labour is very high in cost of cultivation of these variety. Gross income for Jeeraphool variety was found to be ₹64089.20. On an average input-output ratio of aromatic rice varieties that is, Jeeraphool came to 1:1.81. The study suggested that Irrigation facilities are to be developed in the proper way so that farmers can adopt improved technologies with assured irrigation facilities.

### Keywords

Costs and returns, jeeraphool, input output ratio, major aromatic rice

### JEL Codes

C82, Q13, Q18

### INTRODUCTION

Rice is one of the important cereal crops of the world and forms the staple food for more than 50 per cent of population and is known as king of cereals. In world, rice has occupied an area of 160.60 million hectares, with a total production of 738.20 million tonnes and productivity 3424.41 kg/ha. India is the second largest producer of rice after China. India has production of 105.48 million tonnes with productivity 3020 kg/ha.

Aromatic rice is one of the major types of rice. It is a medium- to long-grained rice. It is known for its nut-like and taste. Aroma quality of scented rice is a major character which increases the value of rice in international market. The demand for special purpose aromatic rice has dramatically increased over the past two decades. India emerges as one of the major exporter of rice in international market (Marothia *et al.*, 2007).

In Chhattisgarh, rice is grown in 3.64 million hectares with production of 7.65 million tonnes and productivity 1517 kg/ha. Chhattisgarh has a sizeable area

under various varieties of aromatic rice that is, Jeeraphool, Kapoorbhog Vishnubhog, Dubraj, Tulsimanjari, Badshahbhog, Madhuri, Chini-kapoor, Siyaram, Jawaphool, etc (Yadav & Chandrakar, 2010). These varieties are grown by the farmers in different agro climatic zones of Chhattisgarh state (Gauraha *et al.*, 2002).

### MATERIAL AND METHODS

The present study was undertaken in Balrampur district of Chhattisgarh out of six blocks of Balrampur, three blocks namely Balrampur, Shankargarh and Kusmi were selected for the study. One hundred fifty farmers were selected randomly from three blocks and 50 farmers were selected from each block. The primary data were collected for the year 2014-15, which were related to cost and return of major aromatic rice. Information was collected from the respondents using well designed schedule. To work out the cost of cultivation, cost and returns, measures of farm profit of aromatic rice. Standard method of cost of cultivation has been adopted for

analyzed the data.

## RESULTS AND DISCUSSION

### Demographical Features of the Sampled Households

The demographic characteristics of the sampled farmers in the study area are described in Table 1. It can be seen from the Table 1 that the female population was seen slightly higher than male being 50.34 per cent and in the case of male it was 49.66 per cent. The average family size was found highest in large farms (7.65 per cent) and lowest in marginal farms (6.03 per cent).

Literacy among the family member of sample households was observed to be higher in small farmers 77.44 per cent. Over all literacy was observed to be 76.04 per cent among the sample households. The scheduled tribe, other backward caste and general shared 87.33, 4.67 and 8 per cent to the total population of sample household of the study area respectively.

### Cost of Cultivation of Aromatic Rice

#### Input wise cost of cultivation of Jeeraphool

The present section deals with the input wise cost for cultivation of jeeraphool in the study area. The perusal of Table 2 clearly shows input cost for cultivation of jeeraphool per hectare which was highest in the case of large farms and lowest in the case of marginal farms. Cost of inputs showed increasing trend from marginal to large farmers. It is due to the fact that large farmers could incur more expenditure on modern farm inputs like quality seed, fertilizers, plant protection chemicals, hired labours etc. The overall cost of cultivation of jeeraphool was observed as ₹35236.04 per hectare (Marothia, 2003).

The major share of cost among different cost items were found in labour, bullock and machine power cost

54.85 per cent to the total cost of cultivation out of which 34.72 per cent contribution was of human labour, bullock labour and machine labour together contribute 20.12 per cent. Total input cost was found 82.00 per cent whereas total fixed cost was 18.00 per cent to the total cost. Rental value of land is highest among fixed costs which is 17.03 per cent to the total cost of cultivation.

### Cost and Returns on the Basis of Cost Concept

The cost and returns on the basis of cost concept in the production of jeeraphool have been presented in the Table 3 and 4 which portrays that, on an average Cost A<sub>1</sub>, Cost A<sub>2</sub>, Cost B<sub>1</sub>, Cost B<sub>2</sub>, Cost C<sub>1</sub>, Cost C<sub>2</sub>, and Cost C<sub>3</sub> were worked out to ₹.24182.93, ₹24182.93, ₹24515.03, ₹30515.03, ₹29236.04, ₹35236.04, and ₹38759.64 per hectare respectively on the sample farms. It was noted that rupees 6000 were considered as imputed rental value of owned land for one crop season.

The average income per hectare over different Cost A<sub>1</sub>, Cost A<sub>2</sub>, Cost B<sub>1</sub>, Cost B<sub>2</sub>, Cost C<sub>1</sub>, Cost C<sub>2</sub>, and Cost C<sub>3</sub> were worked out to ₹39906.27, ₹39906.27, ₹39574.17, ₹33574.17, ₹34853.16, ₹28853.16, and ₹25329.56 respectively. The income over different costs also increased with the increase in the farm size because of higher output in relation to total input cost.

### Measures of Farm Profit of Jeeraphool Variety

It is quite evident from table 5 that, on an average, the value of net income, family labour income, farm business income and farm investment income per hectare came to ₹28853.13, ₹33574.15, ₹39906.25, and ₹33585.23 respectively from Jeeraphool. Gross income of the farms by main product and by product together was found to be ₹64089.20 per hectare. The overall input output ratio was

**Table1: Demographical features of the sampled households**

Particulars	Marginal	Small	Medium	Large	Total
<b>1. Total no. of households</b>	30	40	40	40	150
<b>2. Total family member</b>	181	266	278	306	1031
	(100)	(100)	(100)	(100)	(100)
a. Male	82	139	135	156	512
	(45.30)	(52.26)	(48.56)	(50.98)	(49.66)
b. Female	99	127	143	150	519
	(54.70)	(47.74)	(51.44)	(49.02)	(50.34)
<b>3. Average family member</b>	6.03	6.65	6.95	7.65	6.87
<b>4. Education</b>					
a. Literacy percentage	72.93	77.44	75.90	76.80	76.04
<b>5. Social group</b>					
a. Scheduled Tribes	24	38	36	33	131
	(80.00)	(95.00)	(90.00)	(82.50)	(87.33)
b. Other Backward Castes	2	-	1	4	7
	(6.67)		(2.50)	(10.00)	(4.67)
c. General	4	2	3	3	12
	(13.33)	(5.00)	(7.50)	(7.50)	(8.00)

Figures in the parentheses indicate the percentages to total number of households and total number of family

Table 2: Input wise cost of cultivation of Jeeraphool

						(₹/ha)
Sr. No.	Particulars	Marginal	Small	Medium	Large	Overall
<b>(A) Input cost</b>						
1.	Human labour					
	a. Family labour	6077.16 (18.01)	5282 (15.29)	4378.44 (12.47)	3485.51 (9.37)	4721.02 (13.40)
	b. Hired labour	5300 (15.71)	6520.54 (18.88)	7700.22 (21.93)	9983.25 (26.85)	7514.40 (21.33)
	Total human labour	11377.16 (33.73)	11802.54 (34.17)	12078.66 (34.40)	13468.76 (36.22)	12235.42 (34.73)
	c. Bullock power	2152.2 (6.38)	1384.6 (4.01)	888.29 (2.53)	-	1036.54 (2.94)
	d. Machine power	4443.1 (13.17)	5536.9 (16.03)	6257.57 (17.82)	7572.9 (20.37)	6053.25 (17.18)
	Total bullock and machine power	6595.3 (19.55)	6921.5 (20.04)	7145.86 (20.35)	7572.9 (20.37)	7089.79 (20.12)
2.	Total labour cost	17972.46 (53.28)	18724.04 (54.21)	19224.52 (54.76)	21041.66 (56.59)	19325.21 (54.85)
3.	Seed	1233.69 (3.65)	1240.38 (3.59)	1244.68 (3.55)	1250 (3.36)	1242.75 (3.53)
4.	Manure & fertilizer	5518.56 (16.36)	5531.87 (16.01)	5545 (15.79)	5550 (14.92)	5537.54 (15.71)
5.	Plant protection	1371.72 (4.07)	1382.68 (4.00)	1397.51 (3.98)	1400 (3.77)	1389.06 (3.94)
6.	Irrigation	272.28 (0.80)	249.67 (0.73)	239.76 (0.68)	386.68 (1.04)	288.08 (0.82)
7.	Interest on working capital 4 per cent	1054.74 (3.13)	1085.14 (3.14)	1106.05 (3.15)	1185.13 (3.19)	1111.30 (3.15)
	Total input cost	27423.46 (81.29)	28213.78 (81.68)	28757.52 (81.91)	30813.47 (82.87)	28893.94 (82.00)
<b>(B) Fixed cost</b>						
1.	Land revenue	10 (0.03)	10 (0.03)	10 (0.03)	10 (0.03)	10 (0.03)
2.	Rental value of land	6000 (17.79)	6000 (17.37)	6000 (17.09)	6000 (16.14)	6000 (17.03)
3.	Interest on fixed capital	300.5 (0.89)	320 (0.92)	340 (0.97)	360 (0.96)	332.1 (0.94)
	Sub total	6310.5 (18.71)	6330 (18.32)	6350 (18.09)	6370 (17.13)	6342.1 (18.00)
<b>(C) Total cost (A+B)</b>						
		33733.96 (100)	34543.78 (100)	35107.52 (100)	37183.47 (100)	35236.04 (100)

Figures in the parentheses indicate the percentages to the total cost

**Table 3: Cost and returns of jeeraphool variety of aromatic rice among various categories of farms**

Particulars	(₹/ha)				
	Marginal	Small	Medium	Large	Overall
	Farm size				
Cost A <sub>1</sub>	21356.3	22941.78	24389.08	27337.96	24182.93
Cost A <sub>2</sub>	21356.3	22941.78	24389.08	27337.96	24182.93
Cost B <sub>1</sub>	21656.8	23261.78	24729.08	27697.96	24515.03
Cost B <sub>2</sub>	27656.8	29261.78	30729.08	33697.96	30515.03
Cost C <sub>1</sub>	27733.96	28543.78	29107.52	31183.47	29236.04
Cost C <sub>2</sub>	33733.96	34543.78	35107.52	37183.46	35236.04
Cost C <sub>3</sub>	37107.35	37998.15	38618.27	40901.81	38759.64

**Table 4: Income over different cost**

Particulars	(₹/ha)				
	Marginal	Small	Medium	Large	Overall
	Farm size				
Cost A <sub>1</sub>	33381.7	37271.22	43831.92	43509.04	39906.27
Cost A <sub>2</sub>	33381.7	37271.22	43831.92	43509.04	39906.27
Cost B <sub>1</sub>	33081.2	36951.22	43491.92	43149.04	39574.17
Cost B <sub>2</sub>	27081.2	30951.22	37491.92	37149.04	33574.17
Cost C <sub>1</sub>	27004.04	31669.22	39113.48	39663.53	34853.16
Cost C <sub>2</sub>	21004.04	25669.22	33113.48	33663.53	28853.16
Cost C <sub>3</sub>	17630.65	22214.85	29602.73	29945.19	25329.56

**Table 5: Measures of farm profit by different category of farm of Jeeraphool variety**

Particulars	(₹)									
	Marginal		Small		Medium		Large		Overall	
1. Gross income	54738		60213		68221		70847		64089.2	
Yield of main product	q	Total value								
	20	50000	22.05	55125	25.07	62675	26.11	65275	23.52	58820
Yield of by product	23.69	4738	25.44	5088	27.73	5546	27.86	5572	26.34	5269.2
2. Net income	21004.04		25669.22		33113.48		33663.53		28853.13	
3. Family labour income	27081.2		30951.22		37491.92		37149.04		33574.15	
4. Farm business income	33381.7		37271.22		43831.92		43509.04		39906.25	
5. Farm investment income	27304.54		31989.22		33453.48		40023.53		33585.23	
6. Input output ratio	1:1.62		1:1.74		1:1.94		1:1.91		1:1.81	

found to 1:1.81 in Jeeraphool variety of aromatic rice.

**CONCLUSIONS**

It can be concluded that aromatic rice variety of Jeeraphool was found economical in the study area. The yield can be increased by adopting better package of practices. The study suggested that irrigation facilities are to be developed in the proper way so that farmers can adopt improved technologies with assured irrigation facilities.

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## Factors Influencing Crop Diversification as a Tool to Twofold Farmers' Earnings in Uttarakhand

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### ABSTRACT

Crop diversification is an important strategy for overall agriculture development in the country. The present study was an attempt to identify the factors affecting crop diversification in Uttarakhand state of India. The present study is based on primary data. Multistage stratified random sampling technique was followed to select 45 farmers from hill region and 30 farmers from plain region. Multiple linear regression was used to examine the factor affecting crop diversification. The major factors responsible for the change in crop diversification were fertilizer consumption, gross irrigated area, road length, mechanization and certified seeds, at districts, divisions and state level. In case of farm households age of household head, size of farm households, distance to market, off-farm/non-farm income and fertilizer which effects the crop diversification. The creation of basic infrastructural facilities is an essential prerequisite for crop diversification and fostering the process of agricultural development.

### Keywords

Crop diversification, farmers' income, regression

### JEL Codes

Q10, Q11, C21, L25

### INTRODUCTION

India is a country of about 1.24 billion people (Population Census, 2011). More than 70 per cent of India's population lives in rural areas where the main occupation is agriculture. Indian agriculture is characterized by marginal and small farm holdings. Agriculture is a critical sector of the Indian economy. Though its contribution to the overall Gross Domestic Product (GDP) of the country has fallen from about 30 per cent in 1990-91 to less than 13.9 per cent in 2011-12 (Economic Survey, 2011-12), this decrease in agriculture's contribution to GDP has not been accompanied by a matching reduction in the share of agriculture in employment, hence agriculture yet forms the backbone of development. An average Indian still spends almost half of his/her total expenditure on food. About 52 % of the total workforce is still employed by the farm sector which makes more than half of the Indian population dependant on agriculture for nourishment (BIRTHAL *et al.*, 2006). The economy of Uttarakhand is predominantly agrarian, as more than three-fourth of its

population is directly engaged in agriculture for their livelihood. Uttarakhand has only 14 per cent of the total land under cultivation and about 65 per cent of population depends on agriculture for their livelihood. The land holdings are mostly marginal and sub-marginal. Around 71 per cent of the operational holdings of the hill region are less than 1 ha and nearly 29 per cent are up to 4.0 ha (Sankhiyiki Diary Uttarakhand, 2010-11).

In the hills of the Uttarakhand, over 40 crop species and numerous varieties are grown, a diversity which is maintained through diverse cropping patterns, and which has evolved in the context of wide variations in edaphic conditions, coupled with careful selections by farmers. The practice of *Barahnaja* is the name of a sophisticated intercropping system of rain-fed hill farming, the *Barahnaja*-literally meaning '12grains'. This practice involves the sowing of a mixture of crops into a single plot of land such as Rajma (beans, *Phaseolus vulgaris*), urd (black gram, *Vigna mungo*), mung (green gram, *Vignaradiata*), kulath, gahat (horse gram, *Macrotyloma uniflorum*), ramdana (*Amaranthus frumentaceus*),

mandua (finger millet, *Eleusinecoracana*), jhangora (barnyard millet, *Echinochloa frumentacea*), bhatt (soybean, *Glycine soja*), lobia (*Vignacatiang*), kheera (cucumber, *Cucumissativus*), bhang (cannabis, *Cannabis sativus*), naurangi (ricebean,) and ogal (Buckwheat, *Fagopyrum esculentum*) are grown together in a mix which is finely balanced to optimise productivity, maintenance of soil fertility, conservation of crop-diversity, and is geared towards meeting diverse household requirements (Sati, 2012). Hence crop diversification is certainly an important component of the overall strategy for a farm development and is usually viewed as a risk management strategy.

**METHODOLOGY**

To identify the factors affecting crop diversification multiple linear regression analysis was carried out to identify the important factors affecting crop diversification at district as well as in farm household level (Acharya & Basavaraja, 2011).

The diversity index can be expressed as a function of,  $DI = f(X_i)$

Or

$$Y = a + b_1X_1 + b_2X_2 + \dots + b_nX_n + U$$

Where, Y or DI= Diversity Index (%)

$X_i$  = Explanatory variables (i=1, 2,....n)

At districts, division and state level the explanatory variables taken were,

$X_1$  = Fertilizer consumption (kg/ha).

$X_2$  = Percentage of gross irrigated to gross cultivated area.

$X_3$  = Road length (square km)

$X_4$  = Mechanization (includes numbers of manually operated, animal operated and power operated implements)

$X_5$  = Quantity of distributed certified seed (quintals)

At farm household level the explanatory variables were,

$X_1$  = Farm size (hectares)

$X_2$  = Age of the household head (years)

$X_3$  = Households size (numbers)

$X_4$  = Distance to market

$X_5$  = Off farm/ non farm income

$X_6$  = Fertilizer use (kg/ha)

In case of time series data and cross sectional data, to check the multicollinearity among different variable, zero order correlation matrix had been prepared for each districts as well as for farm households level. At districts, division and state level, five variables i.e. fertilizer consumption (kg/ha)  $X_1$ , percentage of gross irrigated to gross cultivated area  $X_2$ , road length(square kilometer) $X_3$ , mechanization (numbers of manually operated, animal operated and power operated implements) $X_4$ , quantity of distributed certified seeds (quintals)  $X_5$ , were taken and for each district zero order correlation matrix has been prepared to check multicollinearity problem. Districts-wise only Dehradun, Haridwar, and Nainital showed the multicollinearity problem among the variables. In

Dehradun, road length was found multicollinear with mechanization and percentage of gross irrigated to gross cultivated area, hence one of the remedy to remove this multicollinearity problem is to drop the variable so that all explanatory variable could show their effect on dependent variable. Same nature of multicollinearity was found in case of Nainital. In Haridwar district, multicollinearity problem also occurred among the variables, hence one of the variable i.e. mechanization, was dropped to remove this problem. No multicollinearity problem arises in case of farm households level.

**RESULTS AND DISCUSSION**

To identify the various factors underlying crop diversification in Uttarakhand, multiple linear regression analysis as has been fitted separately at district, division, state and farm households levels.

**Factors affecting crop diversification at district, division and state level.**

At districts, divisions and state level, the Simpson diversification index was regressed on several causing factors such as fertilizer consumption (kg/ha) ( $X_1$ ), percentage of gross irrigated area to gross cultivated area ( $X_2$ ), road length (sq. Km)( $X_3$ ), mechanization (manually operated, animal operated and power operated implements)(numbers) ( $X_4$ ), and seed distribution (quintals) ( $X_5$ ). To capture the effect of technology adoption, three important variables namely fertilizer use (kg/ha), percentage of gross irrigated to gross cultivated area and seed distribution have been included and for infrastructural development, road connectivity has been taken.

From the Table 1 it can be revealed that fertilizer consumption has positive effect on diversification of Dehradun and Pithoragarh districts, while in other districts its relationship with the crop diversification is negative which indicates the constraint of imbalanced fertilizer use in these districts, while at division and state levels, fertilizer consumption has no any significant effect on crop diversification. The regression coefficient of the percentage of gross irrigated area to gross cultivated area shows the negative relationship with diversification in Pithoragarh and Nainital districts, indicating that the crop diversification is declining with increasing irrigated area and due to irrigation facilities the farmers were moving toward specialization, whereas, contrast to this Uttarkashi district shows the positive relation with diversification index, indicating that in hilly region availability of irrigation increasing diversification of crops.

Road length shows the significant positive relationship with crop diversification in Uttarkashi district indicates that better road inducing diversification in crops due to easy accessibility to markets and low transport cost. In some districts the road shows the insignificant negative relation with crop diversification indicating the poor road connection and condition in the districts. Garhwal division and state as whole shows

insignificant negative effect on crop diversification. Among the districts, Almora, Chamoli, Champawat, Nainital, Rudrapayag and Tehri shows the significant positive effect of mechanization on the crop diversification indicating the more the number of manually, animal and power operated machine the more diversification in crop can be observed, whereas contrast

to this some districts like Pithoragarh and Uttarkashi show negative relation with crop diversification. Distribution of seed has significant dampening effect on crop diversification in Dehradun. While Pithoragarh district registered as a significant positive effect on crop diversification. Division and state as whole show no significant effect on crop diversification.

**Table 1: Estimated regression function for the determinants of crop diversification**

Districts/ Divisions/ State	Intercept	Fertilizer consumption (X <sub>1</sub> )	Per cent of gross irrigated to gross cultivated area (X <sub>2</sub> )	Road length (X <sub>3</sub> )	Mechanization (X <sub>4</sub> )	Certified seed (X <sub>5</sub> )	R <sup>2</sup>
Almora	-4.19	-0.001	0.003	0.0004	0.0006*	-0.0001	0.81
Bageshwar	0.47	0.006	-0.001	0.0002	0.0004	0.00006	0.32
Chamoli	-0.52	0.003	0.0005	0.00001	0.00001**	0.00005	0.87
Champawat	-1.46	-0.0005	0.005	-0.0001	0.0008***	0.00006	0.69
Dehradun	0.49	0.006***	-0.05	-	0.00007*	-0.00008**	0.91
haridwar	0.37	-0.0001	0.003	0.0008	-	-0.0001	0.65
Nainital	-2.05	0.0002	-0.013*	-	- 0.0007***	-0.00002	0.93
Pauri	1.22	0.004	-0.0008	-0.005	-0.00001	-0.0008	0.39
Pithoragarh	1.28	0.02**	-0.02*	-0.0007	-0.00006**	0.00003***	0.95
Rudrpryag	0.26	0.002	-0.0008	-0.00004	0.00001*	-0.00002	0.85
Tehri	-0.144	-0.001	-0.005	0.0005	0.0006*	0.00002	0.87
U S Nagar	1.10	-0.005	-0.002	0.0001	-0.0004	0.0001	0.35
Uttarkashi	0.43**	-0.0001	0.009*	0.0002**	-0.0001*	-0.0002	0.95
Kumaun	1.25	0.0006	-0.01	0.0001	0.0001	0.0003	0.54
Garhwal	3.28	0.002	-0.03	-0.0005	-0.0007**	0.000002	0.85
Uttarakhand	1.81	0.001	-0.006	-0.0002	-0.0005	0.00001	0.70

\*, \*\*, \*\*\* indicate significant at 1 per cent, 5 per cent and 10 per cent probability levels, respectively. Figures in parentheses denote standard error

**Table 2: Factors affecting crop diversification at farm household level**

Variables	Valley	Mid hills	High hills	Overall hills	Plains
Intercept	0.07 (0.40)	1.46 (0.36)	0.12 (0.42)	0.55 (0.39)	0.29 (0.28)
Farm size (ha) X <sub>1</sub>	0.03 (0.06)	0.03 (0.04)	-0.02 (0.11)	0.013 (0.07)	-0.003 (0.005)
Age of the head (years) X <sub>2</sub>	0.01*** (0.008)	0.001 (0.007)	-0.01 (0.06)	0.0003* (0.02)	0.006* (0.001)
Household size (numbers) X <sub>3</sub>	-0.04 (0.02)	-0.003 (0.01)	0.03*** (0.01)	0.02** (0.01)	0.01*** (0.006)
Distance to markets (km) X <sub>4</sub>	0.08 (0.09)	-0.03*** (0.01)	0.03 (0.02)	-0.03 (0.04)	0.01 (0.02)
Off farm/non farm income X <sub>5</sub>	-0.009 (0.0001)	0.001 (0.008)	0.0004 (0.0006)	-0.0002 (0.0001)	-0.008*** (0.009)
Fertilizer (kg/ha) X <sub>6</sub>	-0.001 (0.0009)	-0.07** (0.03)	0.001 (0.0007)	-0.02 (0.001)	0.002 (0.004)
R <sup>2</sup>	0.46	0.59	0.56	0.58	0.47

\*, \*\*, \*\*\* indicate significant at 1 per cent, 5 per cent and 10 per cent probability levels, respectively. Figures in parentheses denote standard error

### Factors affecting crop diversification at farm household level

At farm households level the Simpson Diversification indices was regressed on several causing factors such as farm size (ha) ( $X_1$ ), age of the household heads (years) ( $X_2$ ), households size (numbers)( $X_3$ ), Distance from market (km) ( $X_4$ ), off farm/non-farm income (rupees) ( $X_5$ ), and Fertilizer use (kg/ha) ( $X_6$ ) (Patil & Taillie, 1982).

Table 2 indicates that farm size has no significant effect on crop diversification. Age of the household head shows the significant positive relation in valley, and overall hills and also on plains indicating that older farm operators are more likely to diversify. The size of the farm households exerts a significant positive effect on crop diversification in high hills, overall hills condition and plain region. Significant negative impact of distance to market on the crop diversification was noticed only in mid hills indicating the more the proximity of main road and market, the more is the importance of diversification of crops. Effect of off farm/ non-farm income on crop diversification show significant positive effect in plain region, while in valley and overall hills no any significant relation has been observed. Fertilizer use show the negative effect on crop diversification only in mid hills and no any significant effect on diversification in other hilly altitudes as well as in plains has been found. So it can be inferred that age of the household head and household size has positive effect on crop diversification, while distance to market and fertilizer use show negative effect on crop diversification.

### CONCLUSIONS

The major factors responsible for the change in crop diversification were fertilizer consumption, gross irrigated area, road length, mechanization and certified

seeds, at districts, divisions and state level. In case of farm households age of household head, size of farm households, distance to market, off farm/non-farm income and fertilizer which effects the crop diversification. The creation of basic infrastructural facilities is an essential prerequisite for crop diversification and fostering the process of agricultural development. Crop varietal diversification at farm level has been found less in hilly region in case of paddy (kharif), so emphasis should be given on proper development and dissemination of high yielding varieties (HYV) suitable to hilly environment. The two factors i.e. age of household head and household sizes had positive effect on crop diversification.

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## Economics of Menthol Mint Cultivation in India: Shifting from Traditional Farming to Income Based Farming

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### ABSTRACT

The *Mentha arvensis* (menthol mint) is an important essential oil bearing plant and widely used in food, flavour, pharmaceutical and cosmetic industries. Production costs of traditional crops are now increasing due to the large share of cash inputs and unsupportive market system. These factors have forced the farmers to shift towards other crops that have better potential returns compared to the traditional crops. In this backdrop, the cultivation of medicinal crops is less risky in terms of the incidence of pest attacks, diseases and has potential returns. The present study was conducted in Rampur district of Uttar Pradesh with the objectives to estimate the costs and returns of mentha growing farmers in mentha cultivation. The net return over total cost (cost D) was found to be the highest on large farms with ₹20215 per ha; followed by medium and small size group of farms with ₹15071 and ₹13849 net returns, respectively.

### Keywords

Economic analysis, medicinal and aromatic plants, mentha cultivation

### JEL codes

Q10, Q13, Q15

### INTRODUCTION

India is considered to be the ancient home of perfumes and aromatic plants because it is blessed with a wide variety of soil and climatic conditions which support the enormous plant wealth. It is an aromatic herb plant and its leaves have pleasant odour. Mentha oil is the major derivative of mentha leaves, obtained by steam distillation process. The menthol mint (*Mentha arvensis*) is an important essential oil bearing plant widely used in food, flavour industries. Mentha cultivation in India has proved quite remunerative to the growers, particularly to small land holders and fitted well in the existing cropping system in mint growing area in the country (Ram *et al.*, 1996). Mint growers consider mentha as a bonus crop as it does not disturb or replace the cultivation of any major winter (Rabi) or rainy season (Kharif) crop. Being a labour intensive crop mentha provides various employment opportunities in cultivation, distillation, processing field particularly in rural areas. The large scale commercial cultivation of mentha is done in Indo-

Gangetic plains i.e. in the states of Uttar Pradesh, Punjab and Haryana. About 95 per cent of the crop is grown in Uttar Pradesh and rest 5 per cent in other states. Uttar Pradesh is the leading mentha producing state in terms of area and production with 1.30 lakh ha acreage and an annual production of 20,000 tonnes of oil (Singh & Khanuja, 2007). In Uttar Pradesh, major mentha producing districts are Barabanki, Rampur, Moradabad, Bijnor, Jyotiba Phule Nagar, Pilibhit, Bareilly, Badaun, Shahjahanpur, Sitapur, Hardoi, Unnao, Faizabad, etc.

The sowing of the crop starts from January and continue till March while is harvested during May-June. The end product—mentha oil—is abstracted from the leaves by processing and steam distillation. The arrival of the oil to the physical market starts from July and extends till November. Two to three cuttings can be done for one crop. About 350-400 drums (1 drum = 180 kg) arrive into market during June-November, and the arrivals decline in the off season. (District Horticulture Office, Vikas Bhavan, Rampur)

**STUDY AREA AND METHODOLOGY**

The study was conducted in Rampur district of Uttar Pradesh. Farmers who are cultivating mentha on more than one acre of land were considered as mentha growing farmers. The study was conducted in the Rampur district, one of the most important districts in terms of area and production of mentha. From the district, 2 blocks were selected purposively on the basis of highest area under mentha crop. Two villages each was selected from each selected block, randomly. A pooled list of all mentha growers was prepared for all selected villages. Then the farmers were classified into small (2-5 acres), medium (5-10 acres) and large (above 10 acres) size groups on the basis of size of their operational land holding. A sample of 60 mentha growers was obtained from the selected villages using probability proportion to size method, with a restriction that a minimum of 15 farmers represent each size group.

**RESULTS AND DISCUSSION****Costs in and Returns from Mentha Cultivation**

The profitability of mentha growers was worked out based on CACP cost concepts. The costs in and returns from mentha cultivation was calculated for small, medium and large category of farmers and expressed in rupees per ha. Farmers differ with respect to the extent of resources owned and their use. Some resources are owned by them while others are purchased or hired in different proportions. Farmers give different weightage to different resources for making production decisions. While calculating the profitability of any crop, the consideration of crop is taken differently by different farmers. Some farmers are interested to know the returns over direct costs involved in the crop production, while others are interested in considering the indirect costs as well, such as rental value of land and imputed value of family labour. Therefore, it was considered worthwhile to work out the net returns over various cost concepts viz., Cost A<sub>1</sub>, A<sub>2</sub>, B<sub>1</sub>, B<sub>2</sub>, C<sub>1</sub>, C<sub>2</sub>, C<sub>2</sub>\*, and C<sub>3</sub>. The total costs and returns of mentha cultivation include three components i.e. operational cost, material cost and fixed cost based on all three components of cost.

**Input Use Level in Mentha Cultivation in Rampur District**

The inputs use level in mentha cultivation has been given in Table 1. A perusal of the results indicates that mentha cultivation required a total of 62.51 man days human labour, which was partly contributed by the farmers from the family and partly arranged from external sources. The human labour employment in mentha cultivation on small, medium and large farms was 61.74, 60.90 and 65.49 man days per ha respectively. The pattern of input use indicates that almost a uniform level of human labour employment was observed on all farms, except large farms, where the same was marginally higher. The uniform human labour employment on all size farms was because of the uniform operations required to be done in the crop in the similar way. Marginally higher

**Table 1: Input use level in mentha cultivation in Rampur district**

Particulars	(Per ha)			
	Small	Medium	Large	Overall
Human labour (man days)	61.74	60.90	65.49	62.51
Machine power (hours)	8.25	8.21	8.40	8.27
Seed/ Suckers (kg)	475.75	491.56	525.93	493.34
Fertilizers				
Urea (kg)	287.50	290.60	297.87	291.09
NPK(kg)	98.21	99.87	102.34	99.75
Irrigation (Number)	17.42	17.31	17.68	17.46

labour employment on large size farms may be attributed to the diseconomies in labour use.

The use of machine power in mentha cultivation was found to be 8.27 hours per ha at an aggregate level. The use of machine power input was almost equal on all categories of farms and varied only in a very narrow range.

The average level of mentha suckers (seed) used in the area was 493.34 kg per ha in overall situation, which varied from 475.75 kg per ha on small farms to 525.93 kg per ha on large farms. The level of mentha seed was found to be positively related with size of farm.

The sum of fertilizer use (urea and NPK jointly) in mentha cultivation was estimated to be 390.84 kg per ha in overall situation, whereas the same was 385.71 kg per ha, 390.47 kg per ha and 400.21 kg per ha on small, medium and large categories of farms, respectively. The fertilizer application in mentha cultivation on all categories of farms was observed to be higher than the recommended one, which would not only be uneconomic for the crop in question but also would have other private and social consequences.

Further, the average number of irrigations applied in the crop was more than 17 on all categories of farms. Being a zaid crop, mentha requires frequent (weekly) irrigation during dry season in summers when there are no rains in the study area.

The table also spotted that the input use level of almost all inputs on large farms was higher than their counterparts of small and medium categories.

**Cost in and Returns from Mentha Cultivation****Operational Costs**

It is evident from the Table 2 that in mentha cultivation the human labour plays an important role, since most of the operations are done manually. The operational cost in was observed as important item of total cost of mentha cultivation (Cost C<sub>3</sub>). The magnitude of operational cost was as high as ₹24466 per ha (36.50 per cent of Cost C<sub>3</sub>) at aggregate level, and varied from ₹24309 per ha (33.24 per cent of Cost C<sub>3</sub>) on large farms to ₹24571 per farm (37.77 per cent of Cost C<sub>3</sub>) on small farms. The expenditure on human labour wage was important item of operational

**Table 2: Cost of cultivation in mentha on different size group of farm**

Particulars	Categories of farmers			Overall
	Small	Medium	Large	
(₹/ha)				
<b>Operational cost</b>				
Human labour	12349 (18.98)	12180 (18.92)	13098 (17.91)	12503 (18.67)
Machine labour	1531 (2.35)	1508 (2.34)	1449 (1.98)	1502 (2.24)
Distillation	10691 (16.43)	10759 (16.71)	9762 (13.35)	10461 (15.68)
<b>Sub-total</b>	<b>24571</b> <b>(37.77)</b>	<b>24447</b> <b>(37.97)</b>	<b>24309</b> <b>(33.24)</b>	<b>24466</b> <b>(36.50)</b>
<b>Material cost</b>				
Seed/suckers	2854 (4.38)	2949 (4.58)	3155 (4.31)	2959 (4.41)
Fertilizers	4110 (6.31)	4172 (6.48)	3658 (5.00)	4006 (5.97)
Irrigation water charges	6731 (10.34)	7002 (10.87)	7106 (9.71)	6903 (10.29)
<b>Sub-total</b>	<b>13675</b> <b>(21.05)</b>	<b>14123</b> <b>(21.94)</b>	<b>13919</b> <b>(19.03)</b>	<b>13868</b> <b>(20.69)</b>
<b>Other costs</b>				
Interest on working capital	900 (1.38)	898 (1.39)	889 (1.21)	896 (1.34)
Rental value of land	7000 (10.76)	7000 (10.87)	7000 (9.57)	7000 (10.47)
Land revenue	35 (0.05)	37 (0.07)	40 (0.09)	36.86 (0.07)
Depreciation	3939 (6.05)	1928 (2.99)	1614 (2.20)	2783 (4.15)
Interest on value of owned fixed assets	8991 (13.82)	10083 (15.66)	9019 (12.33)	9289 (13.86)
<b>Sub-Total</b>	<b>20865</b> <b>(32.07)</b>	<b>19946</b> <b>(30.98)</b>	<b>18562</b> <b>(25.38)</b>	<b>20005</b> <b>(29.84)</b>
<b>Total</b>	<b>59131</b> <b>(90.89)</b>	<b>58516</b> <b>(90.90)</b>	<b>56793</b> <b>(77.67)</b>	<b>58339</b> <b>(87.04)</b>
<b>Cost C<sub>3</sub></b>	<b>65050</b> <b>(100.00)</b>	<b>64371</b> <b>(100.00)</b>	<b>62472</b> <b>(100.00)</b>	<b>64181</b> <b>(100.00)</b>

Figures in parenthesis denote the per cent contribution to Cost C<sub>3</sub>.

cost which was estimated to be ₹13502 per ha at aggregate level, and ranged from ₹12180 per ha in case of medium farms to ₹13098 in case of large farm. The expenditure on human labour accounted for 18.98, 18.92 and 17.91 per cent of cost C<sub>3</sub> on small, medium and large size farms, respectively. As a proportion of Cost C<sub>3</sub> per ha, expenditure on human labour was inversely related to size of farm. Distillation charge was another important item of operational cost in mentha cultivation and was estimated to be Rs.10461 per ha at an aggregate level. The same accounted for 15.68 per cent of Cost C<sub>3</sub> at aggregate level, and varied from 13.35 per cent on large farms to 16.71 per

cent of Cost C<sub>3</sub> on medium size farms.

#### Material Cost

It is evident from the Table 2 that purchase inputs like fertilizers, seed (suckers) also played important role in total (Cost C<sub>3</sub>) cost.

The most important material from expenditure point of view was irrigation water charge alone amounted at ₹6903 per ha (10.29 per cent of Cost C<sub>3</sub>) in overall situation. The magnitude of the same on small, medium and large farms was ₹6731, (10.34 per cent of total cost) ₹7002 (10.87 per cent of total cost) and ₹7106 (9.71 per cent of total cost), respectively.

As revealed from the Table 2 that the expenditure on fertilizers, one of the important items of material cost, stood at ₹4006 per ha (5.92 per cent of total cost) at aggregate level, ranged from ₹3658 per ha (5.00 per cent of total cost) on large farms to ₹4172 per ha (6.48 per cent of total cost) on medium size farms.

The Table 2 also indicates that seed was another important item of material cost in mentha cultivation that stood at ₹2854, ₹2949 and ₹3155 per ha on small, medium and large size group of farms, respectively and accounted for more than 4 per cent of total cost of cultivation in all cases.

#### Other Costs

Other costs consisted of the values of: interest on working capital, rental value of owned land, depreciation and interest on value of owned capital assets. A perusal of the table indicates that the interest on value of owned fixed assets was most important item of other costs. The same was estimated to be ₹9289 per ha at aggregate level and accounts for 13.86 per cent of the total cost. The rental value of land was other important item. The rental value of land stood at ₹7000 per ha which accounted for 10.47 per cent of the total cost of cultivation. The depreciation of capital assets, imputed cost was next item of other cost, which was accounted of 4.15 per cent of the total cost of cultivation on aggregate.

Table 3 presents the comparison of various costs (cost concepts given by Commission on Agricultural Costs and Prices) and returns. The perusal of the results suggests that cost A<sub>1</sub>, which included costs of hired labour, suckers, manures and fertilizers, depreciation on farm building and implements, interest on working capital, was found to be ₹40235 per ha at aggregate level which ranged from ₹39237 per ha on large farms to ₹41209 per ha on small farms. In the study area no case of leased in land was found, therefore per ha cost A<sub>2</sub> was equal to cost A<sub>1</sub>.

Cost B<sub>1</sub> was estimated to be ₹49525 per ha at aggregate level, whereas the same was ₹50201, ₹49613 and ₹48257 per ha, respectively on small, medium and large farms. Cost C<sub>1</sub>, which includes cost B<sub>1</sub> and imputed value of family labour, was found to be ₹51346 per ha on overall basis, while the magnitude of the same on small, medium and large farms was ₹52136, ₹51519 and ₹49793 per ha,

**Table 3: Cost concept-wise cost of cultivation of mentha (₹/ha)**

Particulars	Small	Medium	Large	Overall
<b>Costs</b>				
Cost A <sub>1</sub>	41209	39530	39237	40235
Cost A <sub>2</sub>	41209	39530	39237	40235
Cost B <sub>1</sub>	50201	49613	48257	49525
Cost B <sub>2</sub>	57201	56613	55257	56525
Cost C <sub>1</sub>	52136	51519	49793	51346
Cost C <sub>2</sub>	59136	58519	56793	58346
Cost C <sub>2</sub> *	59136	58519	56793	58346
Cost C <sub>3</sub>	65050	64371	62472	64181
Yield of mentha oil (kg/ha)	65.32	65.00	73.85	67.50
Cost of mentha production (₹/kg)	996.87	990.32	845.93	950.83
Price of mentha oil (₹/kg)	1207	1222	1263	1225
Gross returns from mentha cultivation	78899	79442	93332	82892

respectively. Similarly Cost C<sub>2</sub> was found to be Rs.58346 per ha at aggregate level. Per unit area the highest Cost C<sub>2</sub> was observed in case of small farms (₹59136 per ha) whereas the same was recorded minimum (₹56793 per ha) in case of large farms. Cost C<sub>2</sub>\* was similar to Cost C<sub>2</sub> because the same was worked out at actual wage rate (Rs.200 per day), which was higher than minimum wage rate. The total cost of cultivation (Cost C<sub>3</sub>) was estimated to be ₹64181 per ha at aggregate level. The highest per ha total cost of mentha cultivation (₹65050 per ha) was recorded on small farms while the lowest (₹62472 per ha) was observed on large farms. The unit cost of mentha oil production was estimated to be ₹950.83 per kg, which was found to be ₹996.87, ₹990.32, and ₹845.93 per kg on small, medium and large farms, respectively.

Despite of higher input use level on large farms the cost of mentha cultivation was the lowest, at all cost concepts, on large farms. The same was due to scale economies realized on large farms in input use and bulk purchase on large farms.

It could be seen from the Table 4, that the average menthol yield was found to be 67.72 kg per ha on overall basis. The large farmers (73.85 kg per ha) held the highest yield followed by small (65.32 kg per ha) and medium sized farmers (64 kg per ha).

The average price received by the farmers on aggregate level was ₹1225 per kg. Further, the gross returns received in the cultivation of mentha in the study area were ₹82,892 per ha.

Table 4 presents returns from mentha cultivation. Analysis of the table indicates that a gross income of ₹93332 per ha on large farms was figured out as the

**Table 4: Cost of production and returns from mentha crop (₹/ha)**

Net returns over costs	Small	Medium	Large	Overall
Cost A <sub>1</sub>	37689	39911	54095	42656
Cost A <sub>2</sub>	37689	39911	44419	40076
Cost B <sub>1</sub>	28698	29828	45075	33366
Cost B <sub>2</sub>	21698	22828	38075	26366
Cost C <sub>1</sub>	26762	27922	43539	31545
Cost C <sub>2</sub>	19762	20922	36539	24545
Cost C <sub>2</sub> *	19762	20922	36539	24545
Cost C <sub>3</sub>	13849	15071	20215	15872
Return per ₹	1.21	1.23	1.47	1.31

highest gross income while the gross income of ₹78899 per ha realized on small farms was the lowest.

The net return over total cost (Cost C<sub>3</sub>) was found to be the highest on large farms with ₹20215 per ha; followed by medium and small size group of farms with ₹15071 and ₹13849 net returns, respectively.

Net return over direct cost (Cost A<sub>1</sub>) on overall basis was found to be ₹42656 per ha and the same was found to be the highest in case of large farms with a magnitude of ₹54095 per ha and the lowest in case of small farms with a net return of ₹37689 per ha.

At aggregate level, the ratio of gross return to the Cost C<sub>3</sub> that is, the return over one rupee expenditure was calculated to be 1.23 and the figure implies that a net profit of ₹0.23 for every one rupee invested in mentha cultivation. The return over one rupee expenditure on small, medium and large farms was ₹1.21, ₹1.23, and ₹1.47, respectively. The return over one rupee expenditure was found to be positively associated with size of farm.

Mentha crop is considered to be remunerative in comparison to field crops as well as medicinal crops. The magnitudes of the returns over various costs and the ratio of gross return to total cost verify the notion.

## CONCLUSIONS

The favourable climatic condition of Rampur, in general offers vast potential for the development of medicinal and aromatic crops, including mentha. But there is a need to tap this potential so that production will be increased and mentha growers will be benefitted. Production constraints are discouraging the producers to boost their production. In this regards, farmer's field trials and awareness campaigns on improved practices and correct method of use of inputs need to be undertaken for the benefit of mentha producers. Production costs of traditional crops are now increasing due to the large share of cash inputs and unsupportive market system. These factors have forced the farmers to shift towards other crops that have better potential returns compared to the

traditional crops. In this backdrop, the cultivation of medicinal crops is less risky in terms of the incidence of pest attacks, diseases and has potential returns. And this significance is further strengthened by the fact that these crops can be raised as inter crops in plantation crops like sugarcane, coconut, etc. with less difficulty. The trade demand for these crops is also increasing with the increased interest in western consumers towards medicinal systems.

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## Marketable Surplus and Post-harvest Losses of Maize at Producer Level in Tribal Area of Middle Gujarat

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### ABSTRACT

*The Mentha arvensis (menthol mint) is an important essential oil bearing plant and widely used in food, flavour, pharmaceutical and cosmetic industries. Production costs of traditional crops are now increasing due to the large share of cash inputs and unresponsive market system. These factors have forced the farmers to shift towards other crops that have better potential returns compared to the traditional crops. In this backdrop, the cultivation of medicinal crops is less risky in terms of the incidence of pest attacks, diseases and has potential returns. The present study was conducted in Rampur district of Uttar Pradesh with the objectives to estimate the costs and returns of mentha growing farmers in mentha cultivation. The net return over total cost (cost D) was found to be the highest on large farms with ₹20215 per ha; followed by medium and small size group of farms with ₹15071 and ₹13849 net returns, respectively.*

### Keywords

Economic analysis, medicinal and aromatic plants, mentha cultivation

### JEL codes

Q10, Q13, Q15

### INTRODUCTION

Maize (*Zea mays* L.) is one of the most versatile emerging crops having wider adaptability under different agro-climatic conditions. Globally, maize is known as "queen of cereals" because it has the highest genetic yield potential among the cereals. It is popularly known as "corn" is one of the most important cereal crops next to wheat and rice in the world's agriculture economy both as food for human being and feed for the animals (Mukherjee *et al.*, 2015).

A country as whole, the tribal regions and tribal people are the poorest segment of our society. Agriculture is still the main source of livelihood for the rural people. Tribal population is still far away from the benefits of agricultural improved technologies. Poor technology adoption, scarcity of resources, low income and depletion of soil fertility are major obstacles affecting the progress and productivity in overall development of the tribal area.

In 2006, the Ministry of Panchayati Raj was announced that two major Districts named Dahod and Panchmahal were put in country's 250 most backward districts. In Gujarat, these two districts are currently

receiving funds from the Backward Regions Grant Fund Programme (BRGF). Dahod is one of the tribal district of Gujarat State, where total tribal population constitutes 70.89 per cent of the tribal population, out of which 72.19 per cent tribes are agriculturist. In Dahod and Panchmahal district, farmers lives in scattered areas *i.e.* forest, mountain, hills and valleys, generally quite away from urban population. Raising agricultural crops and collection of forest produce are the means of livelihood of tribal. Generally, the agriculture is characterized by the production of food grains, just sufficient to meet their requirements at the level of living. Farmers have poor resources and illiterate which suppress the adoption of recommended practices and utilization of available resources for allocation of different farm enterprises in this area. The Integrated Tribal Development Project, in Dahod was started since 1976, with the objectives to narrow the gap between the level of tribal and other areas of the state and to increase the income from agriculture and there by improve the quality of life of the tribal farmers.

In Gujarat, maize is an important crop traditionally

grown in tribal areas of Panchmahal, Dahod, Banaskantha, Sabarkantha and Vadodara. Area, production and productivity of maize showed the fluctuation during last four years. The area and production of total maize was 4, 57,700 hectares and 7, 90,500MT, respectively, during 2012-13.

The basic thought behind the selection of this topic is to analyze the total production, consumption, marketable surplus and post-harvest losses of maize at producer level in Tribal Area of Middle Gujarat.

**METHODOLOGY**

A multistage sampling was adopted as appropriate sampling procedure for the study. In the first stage, out of nine districts, of Central Gujarat Dahod and Panchmahal districts were selected purposively on the basis of concentration of area under maize crop. Two talukas from each selected district *i.e.*, Devgadh Bariya and Zalod talukas from Dahod district and Godhra and Lunawada talukas from Panchmahal district were chosen purposively on the basis of concentration of the area under maize crop. Further, in third stage, three villages were selected randomly from each selected talukas. Thus, total twelve villages were selected for the study. The next stage of planning was to select 120 maize growers. 10 respondents were selected from each village for detailed study. Thus, in all, 120 (10 × 12) respondents of maize growers spread over 12 villages of Panchmahal and Dahod districts were comprised as the ultimate sample size for the detailed inquiry for the year 2014-15.

**Marketable Surplus**

The marketable surplus of the maize was worked out by subtracting the requirement for family consumption, seed, labour and relatives from the total production of the crop on the farms. Symbolically,

$$MS = P - C$$

Where,

- MS = Marketable surplus,
- P = Total production
- C = Total requirements

**Factors affecting marketable surplus**

The determinants of marketable surplus of maize were examined through regression technique after identifying the most plausible variables. Both linear and Cobb-Douglas production functions were tried to examine the factors affecting marketable surplus of maize. However, statistically linear form of the following type was found more appropriate on the basis of R<sup>2</sup> and significance of variables.

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + u$$

Where,

- Y= Marketable surplus of maize in Rs.
- X<sub>1</sub>= Production of maize in q/household
- X<sub>2</sub>= Home consumption in q/house hold
- X<sub>3</sub>= Family size in adult unit
- X<sub>4</sub>= Farm size in hectare
- X<sub>5</sub>= Education of head of family assigning value

0,1,2,3 and 4 for illiterate, primary, secondary, higher secondary and college.

b<sub>0</sub>= Intercept

u= Error term

**Post-harvest losses**

Post-harvest losses occur between harvest and the moment of human consumption. The data of post-harvest losses were calculated on the basis of opinion of farmers collected through well-structured interview schedules. They include on-farm losses, such as when grain is harvest, threshed, and winnowed, as well as losses along the chain during transportation and packing. Therefore, the post-harvest losses were analyzed at the different stages *i.e.* harvesting, threshing, winnowing, packing and transportation by using the tabular analysis.

**RESULTS AND DISCUSSION**

**Marketable surplus and factors affecting the marketable surplus**

**Utilization pattern**

Total production, utilization and marketable surplus of maize are presented in Table 1. It is evident from the table that the total production was 3261 quintals. Out of this on farm utilization was 36.77 per cent. The quantity considered as for home consumption accounted for 16.82 per cent, for animals 11.25 per cent, for relatives 05.31 per cent, for wage purpose 02.10 per cent and for seed purpose it was 01.29 per cent. The marketable surplus of maize was found 63.23 per cent of the total production. Similar type of results was obtained by Chauhan & Chahabra (2005). It was concluded that maize is the main food crop in the studied tribal area so major portion of the production was used for the home consumption, animals and relatives.

**Table 1: Marketable surplus of maize crop on the sample farms**

Particular	Quantity per farm (q)	Total quantity (q)	Per cent to total production
<b>1. Total production</b>	<b>27.13</b>	<b>3261.00</b>	<b>100.00</b>
<b>2. On farm utilization</b>			
(a) Home consumption	4.56	548.00	16.82
(b) Wage purpose	0.57	69.20	02.10
(c) Seed	0.35	42.50	01.29
(d) Relatives	1.44	173.00	05.31
(e) Animal	3.05	366.00	11.25
Total (a to e)	9.97	1198.70	36.77
<b>3. Marketable surplus (1-2=3)</b>	<b>17.13</b>	<b>2062.3</b>	<b>63.23</b>

There are many factors which affect the quantity of marketable surplus of maize and most important among them are presented in Table 2. It can be seen from the table that the farm production and farm size had positive and highly significant effect on the marketable surplus of

maize, whereas, home consumption and family size had negative significant effect on the marketable surplus. These factors explained nearly 67 per cent variation in marketable surplus of maize. Chauhan (2013) estimated the factors affecting marketed surplus of maize and stated that animal feed, education of head of family, family size had a positive effect on marketed surplus while, home consumption had a negative effect.

**Table 2: Factors affecting the marketable surplus**

Variables	Coefficients	Standard errors
Intercept (b <sub>0</sub> )	11.12	0.8263
Farm production (X <sub>1</sub> )	0.2655 <sup>***</sup>	0.0250
Home consumption (X <sub>2</sub> )	-0.1092 <sup>**</sup>	0.0498
Family size(X <sub>3</sub> )	-0.1250 <sup>**</sup>	0.0524
Farm size (X <sub>4</sub> )	0.1723 <sup>***</sup>	0.0695
Education of head (X <sub>5</sub> )	0.181 <sup>NS</sup>	0.0524
<b>R<sup>2</sup></b>	<b>0.67</b>	

<sup>\*\*</sup> and <sup>\*\*\*</sup> Significant at 0.05 and 0.01 per cent level.  
NS: Non-significant

**Table 3: Post-harvest losses of maize at producer's level**

Stage of loss	Total losses (kg/farm)	Loss (Per cent)
Harvesting	8.79	23.50
Threshing	10.85	29.0
Winnowing	6.22	16.66
Packing	4.84	12.27
Transportation	6.93	18.57
<b>Total</b>	<b>37.63</b>	<b>100.00</b>

**Post-harvest losses of maize at producer level**

The post-harvest losses of maize at producer's level were depicted in Table 3. It was found that total post-harvest losses in quantity were 37.63 kg. The results

revealed that highest (29.0 per cent) post-harvest losses was assessed in threshing operation, followed by harvesting (23.50 per cent), transportation (18.57 per cent), winnowing (16.66 per cent) and packing (12.27 per cent) operations. The highest losses in threshing operation were observed may be due to less use of mechanical threshers by farmers. Farmers usually practice manual threshing in study area which sometimes leads to grain damage. Chauhan & Kumar (2010) estimated the production, marketed surplus and post-harvest losses in maize crop of India and found that the losses in threshing (21.56 per cent) contributed maximum to the post-harvest losses.

**CONCLUSIONS**

The marketable surplus of maize per farm was found about 17.13 quintal which was 63.23 per cent to total production. Total post-harvest losses in quantity were 37.63 kg per farm. Threshing contributed highest to post harvest losses followed by harvesting, transportation, winnowing and packing operations. Hence, they should be made aware about mechanical threshers or latest technology to reduce these losses at producer level and get better yield and income.

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## Economic Impact of Sardar Variety of Guava in Maharashtra

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### ABSTRACT

In Maharashtra Sardar Guava cultivated in 40,000 ha with annual production of 3.24 lakh metric tonnes and productivity of 8.1 t/ha. The grafts of Lukhnow-49 sold were 5,51,521 from the year 1931 to 2016 and it has replaced 1991 hectares of area under Local varieties of guava and other crops like sugarcane. The benefit–cost ratio of an investment made in Lukhnow-49 research was observed 1.35 in Maharashtra and growers were largely benefitted due to adoption of technology and the research. The additional returns in cultivation of Lukhnow-49 variety of guava were of ₹55,282/ha and economic impact was ₹28.94 crores for the year 2015-16.

### Keywords

Benefit-cost ratio economic impact, Sardar guava, technology and research

### JEL Codes

C82, D61, L11, O13

### INTRODUCTION

Guava is an important fruit of tropical and subtropical area of the world, commonly called as poor man's fruit. In India guava occupies an area of 2.03 lakh hectares with annual production of 22.7 lakh metric tonnes. In India it is cultivated almost throughout area except higher hills. Two main cultivars which originated in Allahabad and Lucknow in Uttar Pradesh occupies most of the area under guava. It grows well throughout the states of Punjab, Haryana and Uttar Pradesh, Zarkhand, Madhya Pradesh, Maharashtra, Karnataka, Andhra Pradesh, Gujarat etc..

In Maharashtra Sardar Guava is largely cultivated in Nasik, Ahmednagar, Pune, Satara, Sangli, Solapur districts and many other parts of the state. About 40,000 ha in Maharashtra is under guava cultivation with annual production of 3,24, 000 metric tonnes and productivity of 8.1 tonnes per hectare (Anonymous, 2010). The guava fruits are in great demand all the year round in Mumbai and Pune markets.

The area under Sardar Guava is gradually expanding in Maharashtra and Sardar Guava is highly remunerative even without much care. Hence, there is need to compare Sardar Guava with local varieties viz; Kothrud, Nasik, Sind, Dholka, Dharwar and Nagpur Seedless and to what extent it has replaced these local varieties in

Maharashtra. The present study is an attempt to analyze the economic impact of Sardar Guava cultivation in Maharashtra.

### METHODOLOGY

The data on planting material sold to the farmers from the year 1931 to 2016 from Ganeshkhind Nursery, Pune of Sardar Guava were collected. The information on area, production and productivity has been collected from different sources such as Directorate of Horticulture, District Superintending Agriculture Officers and guava growers in Maharashtra.

The data on input use structure and costs and returns structure of Sardar Guava and Local varieties of guava viz; Kothrud, Nasik, Sind, Dholka, Dharwar and Nagpur Seedless were collected by survey method from sample guava growers' for the year 2014-2015. The data collected from the guava growers were used for estimating net gains of Sardar Guava over Local varieties by using partial budgeting technique.

There are four components in partial budgeting. First, the added costs due to the new technology over the control are considered. In this study the control or check variety of guava is Local varieties. The second component is the reduced returns or reduced income due to new technology in relation to the control. This includes reductions in yield

due to new technology, reduction in yield due to reduced planting, harvest timeliness, reduction in rental income, reduction in custom work income and so on. Both these add to the 'costs side' or debit side of the partial budget. The third component is the reduced costs due to new technology over the control which includes reductions or total elimination of certain expenses such as seed, labour, repairs and interest expenditure. Here too, including non-cash costs such as family labour and depreciation provides a full economics analysis instead of mere changes in cash costs. The fourth component is the added income due to the new technology over the control, due to increase in yield, quality and other benefits if any. The

third and fourth components add to the 'return side' or the credit side of the partial budget.

In order to develop a new technology, the SAU system incurs costs on salaries of researchers and staff in addition to other expenditure are compounded from the period and then amortized to obtain the research cost per year (at a modest rate of 2 per cent considering the public investment expenditure). Similarly, the new technology dissemination involves the cost of extension incurred on demonstrations and the personnel involved in the process. Also, to the research cost, the demonstration expenditure and salaries of extension personnel are also compounded and amortized. The sum of the amortized cost is

**Table 1: District wise area, production and productivity of guava in Maharashtra**

**(Area in ha, Production in Tonens and Productivity in t/ha)**

Districts	Guava			Sardar (Lukhnaw-49)		
	A	P	Y	A	P	Y
Thane	18.30	216.30	11.82	17.38	205.49	11.82
Palghar	111.30	672.60	06.04	105.73	638.97	6.04
Ratnagiri	00.40	02.20	05.50	0.38	2.09	5.50
Raigad	38.00	68.00	01.79	36.10	64.60	1.79
Shindudurg	08.00	85.00	10.63	7.60	80.75	10.63
Nasik	1105.00	9945.00	09.00	1049.75	9447.75	9.00
Dhule	178.00	2174.00	12.21	169.10	2065.30	12.21
Nandurbar	60.40	605.50	10.02	57.38	575.23	10.02
Jalgaon	500.00	6500.00	13.00	475.00	6175.00	13.00
Ahmednagar	920.00	13156.00	14.30	874.00	12498.20	14.30
Pune	1120.00	15568.00	13.90	1064.00	14789.60	13.90
Solapur	4032.00	46472.00	11.53	3830.40	44148.40	11.53
Satara	223.60	1925.60	08.61	212.42	1829.32	8.61
Sangli	372.00	6696.10	18.00	353.40	6361.30	18.00
Kolhapur	54.60	442.30	08.10	51.87	420.19	8.10
Jalana	287.60	5697.00	19.81	273.22	5412.15	19.81
Beed	271.40	2865.00	10.56	257.83	2721.75	10.56
Aurangabad	505.00	7070.00	14.00	479.75	6716.50	14.00
Latur	132.00	1375.40	10.42	125.40	1306.63	10.42
Osmanabad	635.00	6725.00	10.60	603.25	6388.75	10.59
Nanded	19.00	310.00	16.32	18.05	294.50	16.32
Parbhani	291.00	2640.00	09.07	276.45	2508.00	9.07
Hingoli	0.00	0.00	0.00	0.00	0.00	0.00
Buldhana	355.20	5150	14.50	337.44	4892.50	14.50
Akola	158.30	1796.70	11.35	150.39	1706.87	11.35
Washim	30.00	225.00	07.50	28.5	213.75	7.50
Amravati	88.60	614.00	06.93	84.17	583.30	6.93
Yeotmal	26.80	378.00	14.10	25.46	359.10	14.10
Wardha	12.00	72.00	06.00	11.40	68.40	6.00
Nagpur	123.60	1001.00	08.10	117.42	950.95	8.10
Bhandara	40.00	522.50	13.06	38.00	496.38	13.06
Chandrapur	12.40	99.20	08.00	11.78	94.24	8.00
Gadchiroli	250.00	3000.00	12.00	237.5	2850.00	12.00
Gondia	30.40	319.20	10.50	28.88	303.24	10.50
Maharashtra	12009.90	144388.60	12.02	11409.41	137169.17	12.02

Source: Anonymous (2010)

distributed across the estimated area under the new technology as envisioned by the researcher (Dahiya, 2002). The figure of net gains by cultivating Lukhnow-49 variety of guava instead of Local varieties calculated used for estimating the economic impact.

## RESULTS AND DISCUSSION

### Area, Production and Productivity of Guava in Maharashtra

The district wise information on area, production and productivity of guava and also Lukhnow-49 variety of guava in Maharashtra for the year 2013-2014 is presented in Table 1.

*Sardar Guava* released by Botanical Garden, Ganeshkhind, Pune in the year 1927. Lukhnow 49 also known as Sardar, its fruits are large, roundish ovate in shape, skin primrose yellow and pulp white, very sweet and tasty. The total soluble solids (TSS) and vitamin C contents are high. The trees are vigorous. It is a selection is from Allahabad Safeda. The trees are spreading with drooping branches. It is dwarfier than Allahabad Safeda has dense foliage. The number of seeds is more than Allahabad Safeda. It is heavy bearer. Yield per tree annually may be 2 quintal or more. TSS of juice is 12.5 per cent.

The major guava growing districts in Maharashtra are Solapur, Pune, Ahmednagar and Nasik as the productivity of guava is at higher level in these districts and the demand for guava fruits is very high in these districts. The adoption of Lukhnow-49 variety of guava was relatively more in Solapur, Nasik and Pune districts. However, less adoption was noticed in Shindhadurg, Wardha and Chandrapur districts. The area under guava in

Maharashtra was 12010 hectares while Lukhnow-49 was 11409 hectares during the year 2013-2014. The production of guava was 1,44,388t/ha and Lukhnow-49 was 1,37,169 t/ha with productivity 12.02 t/ha.

### Qualitative and Growth Parameters of Local and Improved Varieties of Guava

The qualitative parameters and ancillary growth observations recorded at station trials of local and improved varieties of guava are given in below, respectively.

### Economics of Production Local and Improved Variety of Guava

The economics of production local and improved variety of guava (*Sardar guava*) has been worked out during the year 2013-2014 and depicted in Table 1. The gross monetary returns of Local varieties were ₹3.12 lakh/ha. While, that of Lukhnow-49, it were ₹4.00 lakh/ha. The cost of production of Local varieties was ₹1.87 lakh/ha and Lukhnow-49 was ₹2.18 lakh/ha and it resulted into net monetary returns of ₹1.25 and ₹1.81 lakh/ha., respectively. The benefit-cost ratios of Local varieties and Lukhnow-49 are 1.67 and 1.83, respectively. [These findings were in consonance with the finding reported by Naphade *et al.* (2008).

### Planting Material of Sardar Guava Supplied by MPKV, Rahuri

The information on planting material of *Sardar guava* distributed to the farmers by the Horticulture Nursery, Ganeshkhind, Pune during the period from 1931 to 2016 is given in Table 2.

The grafts of Lukhnow-49 sold were 5,51,521 from the year 1931 to 2016 and it has replaced 1991 hectares of

### Qualitative and growth parameters of local varieties of guava

Nasik	Dharwar	Sind	Dholka	Kothrud
Tree is erect in habit, bears bottle shaped fruits and fruit is hard and more seeded also it has rough skin.	Tree is bushy with elliptical hard fruits which taper towards stalk end. Many seed. Pulp is sweet	Tree is bushy and spreading habit. Fruit has few and soft seeds and fruit elliptic round in shape.	Tree is vigorous in growth. Fruit is fairly big delicious and have a few soft seeds. Pulp slightly acidic	Medium sized tree with an open and erect habit. Fruits large in size, pear shaped with narrow neck & rough surface

### Qualitative and growth parameters of improved varieties of guava

Qualitative parameters	Allahabad Safeda	Sardar (Lukhnow-49)
Tree growth habit	The trees are vigorous and compact. It is taller than Lukhnow-49, usually with round crown and dense foliage	The trees are spreading with drooping branches. It is dwarfier than Allahabad safeda have dense foliage.
Plant height	The trees grows up to 7 to 8 metre high	The trees grow at maturity up to height of 6 metre.
Fruit weight	150 to 200 gm	200 to 250 gm
Fruit colour	Yellowish white	Yellowish green
Fruit shape	Pear shaped	Roundish ovate
Seed hardness	Numerous, bold and hard	Medium hard
Fruit pulp	White, sweet, soft, melting	White, sweet
Yield/ha	20 to 25 tons	25 to 30 tons

**Table 2: Economics of production of local and improved varieties of guava**

Particulars	₹/ha	
	Local varieties	Sardar (Lukhnow-49)
Yield of fruits (t/ha)	12.50	20.00
Gross monetary returns	3, 12, 500	4, 00, 000
Cost of production	1, 87, 055	2, 18, 532
Net monetary returns	1, 25, 445	1, 81, 468
B: C ratio	1: 1.67	1: 1.83

area under Local varieties of guava and other crops like sugarcane in Maharashtra as the planting material was distributed to Fruit Research Stations, Government and private Nurseries and progressive contact farmers and from them the farmers have purchased the planting

material. The planting material has been supplied only on demand submitted in advance by Government and Co-operative organizations in the state and other states, Agricultural Universities in the country and also by the farmers. The planting materials have been purchased in other states during 1930 to 1950 for conducting experiments for comparing Lukhnow-49 with the local varieties as well as for commercial cultivation and this variety found superior then all fruit research institutes in the country have purchased planting material from Ganeshkhind Nursery for using it as mother plants. Now, Lukhnow-49 is largely grown in other states like Andhra Pradesh, Madhya Pradesh, Jharkhand, Karnataka, Uttar Pradesh and West Bengal.

**Present area Under Guava whose Planting Material Supplied by Ganeshkhind Nursery**

The information on present area under guava whose

**Table 3: Planting material distributed of Sardar guava (Lukhnow-49) from 1931 to 2016**

Time Periods	Year wise planting material supplied					Total
	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year	
1931-1935	746	799	851	895	950	4,241
1936-1940	997	1050	1100	1149	1200	5,496
1941-1945	1900	2050	2112	2150	2200	10,412
1946-1950	1850	1903	1945	2013	2146	9,857
1951-1955	1417	1518	1617	1701	1805	8,058
1956-1960	1894	1995	2090	2183	2280	10,442
1961-1965	3610	3895	4013	4085	4180	19,783
1966-1970	3515	3616	3696	3825	4077	18,729
1971-1975	2693	884	972	4231	4430	13,210
1976-1980	5599	5791	5971	6148	6332	29,841
1981-1985	7859	8401	9624	10762	16972	53,618
1986-1990	12302	17395	12386	15818	10687	68,588
1991-1995	10687	11636	5127	28490	21829	77,769
1996-2000	7462	12720	12461	4088	10056	46,787
2001-2005	6232	2176	4439	11147	9076	33,070
2006-2010	14594	8570	15518	9909	7205	55,796
2011-2015	8587	10672	10599	15599	27893	73,350
<b>2015-2016</b>	--	--	--	--	--	12,474
<b>Total planting material supplied along with production technology</b>						<b>5,51,521</b>

**Table 4: Present area under guava whose planting material supplied by Ganeshkhind Nursery**

Time Periods	Year wise area planted					Total
	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year	
1976-1980	20.21	20.91	21.56	22.19	22.86	107.73
1981-1985	28.37	30.33	34.74	38.85	61.27	193.57
1986-1990	44.41	62.80	44.71	57.10	38.58	247.61
1991-1995	38.58	42.01	18.51	102.85	78.81	280.75
1996-2000	26.94	45.92	44.99	14.76	36.30	168.91
2001-2005	22.50	7.86	16.03	40.24	32.77	119.39
2006-2010	52.69	30.94	56.02	35.77	26.01	201.43
2011-2015	31.00	38.53	38.26	56.31	100.70	264.80
<b>Total area planted from planting material supplied from Ganeshkhind</b>						<b>1584.18</b>

**Table 5: Economic impact of Lukhnow-49 variety of guava by partial budgeting technique**

(₹/ha)

Debit Side (A + B)		Credit Side (C + D)	
A. Added costs due to use of Lukhnow-49 variety of guava		C. Reduced costs due to use of Lukhnow-49 variety of guava	
Items	Cost	Items	Cost
i. Seedling cost of Local varieties 400 seedlings ×15	6000	Labour for digging and filling of pits for Local varieties 400×₹50/pit for digging and ₹10/pit for filling	24,000
ii. Cost of grafts of Lukhnow-49 variety 277 grafts×50	13850		
iii. Added cost of planting material due to use of Lukhnow-49	7850	Labour for digging and filling of pits for Lukhnow-49	18,005
iv. Labour for Topping/Pruning of Local varieties	0	277×₹50/pit for digging and ₹15/pit for filling	
v. Labour for Topping/Pruning of Lukhnow-49 variety 10 days ×5 = 50 male labour @ ₹200/day	10000	Savings in digging and filling of pits	5,995
vi. Added cost of Topping/Pruning due to use of Lukhnow-49	10000	Material used for filling of pits	
vii. Labour for harvesting for Local varieties 10 days ×5 = 50 male labour @ ₹200/day	10000	Cost of material used for filling of pits of Local varieties 400× ₹40/pit for manure	16,000
viii. Labour for harvesting for Lukhnow-49 20 days ×5 = 100 male labour @ ₹200/day	20000	Cost of material used for filling of pits of Lukhnow-49 277×₹30 for FYM & ₹6 for SSP & Rs.12 for Folidol	13,296
ix. Added cost of harvesting due to use of Lukhnow-49	10000	Savings in material used for filling of pits	2,704
x. Added cost of grading, packing and packing material	5000	Total Reduced costs	8,699
xi. Added cost of chemical fertilizer	1800		
xii. Added cost of labour for chemical fertilizer application	600		
xiii. Total additional cost due to planting material, fertilizer and labour for pruning and harvesting (additional working capital)	35250		
xiv. Interest on additional working capital @ 6 % for 12 months	2115		
xv. Risk premium @ 10% of additional working capital	3525	D. Added returns due to Lukhnow-49 variety	Return
xvi. Research and extension cost per hectare	27	Returns of Lukhnow- 49 = 20 tonnes× ₹20,000	4,00,000
Total of added costs	40,917	Returns of Local varieties = 12.5 tonnes× ₹25,000	3,12,500
B. Reduced Returns from Lukhnow-49 variety	0	Total Added returns	87,500
Total Debit side (₹)	40,917	Total credit side (₹)	96,199

Economic worthiness of Lukhnow-49 variety: Credit minus Debit = ₹96,199 – ₹40,917 = ₹55,282 /ha.

Incremental net benefit cost ratio is 55,282/40,917 = 1.35

planting material supplied by Ganeshkhind Nursery to the farmers during the years 1931 to 2016 is given in Table 3.

The grafts of Lukhnow-49 sold by Ganeshkhind Nursery were 4,51,293 from the year 1976 to 2016 and it

has replaced 1584 hectares of area under Local varieties and other crops in Maharashtra. The present area under Sardar guava in Maharashtra is 11,409 and 1,584 ha area under Sardar guava is from planting material purchased

**Table 6: Economic benefits from the cultivation of Lukhnow-49 variety over check Local varieties in Maharashtra**

Economic impact of using Lukhnow-49 variety of guava	Cost (₹)
Probability of performance of this technology = 0.85	0.85
Rate of adoption of this technology = 0.60	0.60
Depreciation of technology (if 1, no depreciation)	0.90
Economic impact of Lukhnow-49 Variety considering field conditions per acre = ₹55,282×0.85×0.6×0.9 = ₹25,374 per hectare	25,374
Total area adopted = 11,409 hectares× 25,374	26,86,93,359
<b>Total economic impact on 11,409 hectares (₹)= 25,374×11,409 = ₹28,94,91,966</b>	<b>28,94,91,966</b>
No. of years for developing Lukhnow-49 variety	20
Cost of salaries of researchers plus staff for 20 years (₹)	1,93,67,500
Research cost of project per year	2,17,612
Cost of extension per demonstration	35,000
Total cost of 5 demonstrations	1,75,000
Cost of Salaries of extension workers plus staff (₹) for 5 years	72,00,000
Research cost per hectare	19.07
Amortized cost of extension per year	80,899
Extension cost per hectare	7.09
Total research and extension cost per hectare	26.16

from Ganeshkhind Nursery. Thus, 13.88 per cent of the area under guava is from planting material purchased from Ganeshkhind Nursery.

#### Partial Budgeting Technique

The partial budget of cultivation of Lukhnow-49 by replacing Local varieties of guava has been prepared and given in Table 1 and Table 2. The net gains due to cultivation of Lukhnow-49 by replacing the Local varieties was ₹55,282/ha as the added costs were ₹40,917/ha and added returns and reduced costs were ₹96,199/ha. The incremental benefit-cost ratio was 1.35

The partial budget estimates the economic impact which has to be weighted with the probability of performance, rate of adoption of technology and depreciation. Probability of performance of the new variety in the field is assumed to be 0.75 since the scientists indicated that the varietal performance in the field conditions is to the tune of 0.85 as opposed to 1.00 in the controlled conditions. Rate of adoption of the new variety is estimated to be 0.6 as indicated by the extension personnel, who conducted the field trials. Any technology will have depreciation because of the product life cycle of technology. A depreciation of 1.00 implies, no depreciation, while that of 0.9 implies depreciation of 10 per cent.

Total economic impact of new variety =  $55,285 \times 0.85 \times 0.6 \times 0.9 = ₹25,374$  per hectare assuming the operation of LDNR. This benefit of ₹14905 per hectare is linearly extrapolated to cover the area 11,409 hectares under the Lukhnow-49 variety of guava to

obtain ₹28.94 crores in the year 2015-16.

#### CONCLUSIONS

The benefit-cost ratio of an investment made in Lukhnow-49 research was observed 1.35 in Maharashtra. This has revealed that the producers of Lukhnow-49 in Maharashtra were benefitted by ₹1.35 when one rupee investment made by the government to Lukhnow-49 research. Thus, the Lukhnow-49 growers in Maharashtra were largely benefitted due to adoption of technology and the research expenditure made in Lukhnow-49.

#### SUGGESTIONS

The additional returns in cultivation of Lukhnow-49 variety of guava were to the tune of ₹55,282/ha and economic impact was ₹28.94 crores for the year 2015-16. Thus, the technologies evolved i.e. improved variety Lukhnow-49 has largely benefitted to the society as a whole in Maharashtra which has indicated that there is wide potential for carrying out further research on guava as the benefit-cost ratio of investment in research on Lukhnow-49 was found at higher magnitude.

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## Vegetable Production Technology for Higher Returns in Maharashtra<sup>#</sup>

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### ABSTRACT

The 486 vegetable growers (onion, tomato, chili, brinjal and okra) from nine agroclimatic zones of Maharashtra were selected and the study pertains for the year 2006-07. The level of adoption of FYM was > 75 per cent in the case of 24.28, 46.28, 31.96, 27.20 and 17.20 per cent of onion, tomato, chilli, brinjal and okra growers, respectively. The fertilizer application ranged from 50 to 75 per cent in the case of onion, tomato, chilli, brinjal and okra growers, respectively. The B:C ratio for vegetables viz; tomato, brinjal, chilli, okra and onion were 2.49, 3.16, 3.29, 3.74 and 4.11, respectively. The total variation explained by the variables ranged from 85 to 92 per cent for adopters and 77 to 96 per cent for non-adopters.

### Keywords

B: C ratio, production technology, resource use efficiency, resource use structure

### JEL Codes

C81, C61, D24, O13, Q13

### INTRODUCTION

Technological change implies a downward shift in the cost function/ rightward shift in the supply function with consequent increased consumption at lower cost. Since technological innovations, by definition, have both resource saving and resource augmenting effects, it is expected to influence the distribution of income. Thus, it could improve the distribution of real income both in the urban and rural spectrum of groups, the producers consumers and market intermediaries, labourers (Pawar *et al.*, 2014)

Considering the importance of vegetable crops, four agricultural universities of Maharashtra viz; MPKV, Rahuri, PDKV, Akola, MKV, Parbhani and Dr. BSKKV, Dapoli are engaged in vegetable research. Since the inception of these agricultural universities, 65 high yielding varieties / F<sub>1</sub> hybrids in 22 vegetable crops have been developed and released. About 244 vegetable production technologies (related to production technologies-125, protection technologies - 79 and post-harvest management and processing - 40) have been standardized and passed on to the farmers of the state

(Anonymous, 2012). Therefore, it was felt necessary to assess the overall impact of these technologies on resource use and cost and return structure in Maharashtra with the objectives To assess the level of adoption of improved vegetable production technologies and examine the impact of improved technologies on resource use structure and resource use efficiency of the major vegetable viz. onion, tomato, chili, brinjal, and okra

### METHODOLOGY

The paper envisages the detailed analysis of assessment of improved vegetable production technologies on production, resource use, income and employment pattern of vegetable growers in Maharashtra. The details of methodological aspects are outlined as below.

#### Data Collection

The farm level data were obtained by the survey method from adopters and non-adopters sample farms through the specially designed schedule.

#### Sampling Technique

From the nine agro-climatic zones of Maharashtra, two tahsils from each of the zones having the highest area

<sup>#</sup> The paper is based on Ad hoc Project, 'Impact Assessment of Vegetable Research on Production, Income and Employment Generation in Maharashtra' submitted to ICAR in February 2012.

under vegetable and three villages from different eco-units having highest area under vegetable were selected purposively. The total sample comprised of 486 farmers growing major vegetables like onion, potato, tomato, brinjal and okra from 54 villages of 18 tahsils in Maharashtra were studied. Besides adopters, 162 non-adopters were also considered for the study. The data used referred to the year 2006-07.

#### Analytical Procedure

A brief description on analytical procedure deployed in the present paper is as under-

#### Technological adoption index

In order to measure the extent of use of vegetable production technology on area basis in terms of use of high yielding varieties, application of farm yard manures, use of plant protection measures and chemical fertilizers, the area under particular item under consideration was converted in percentage. Further, technology adoption score for individual farm for the important vegetables viz., onion, tomato, chilli, brinjal, okra, was computed by using the simple method.

Under this method six key inputs like area, variety, FYM, fertilizers and plant protection measures. The 4 points for 75 to 99 per cent, 3 points for 50 to 74 per cent area, 2 points for 25 to 49 per cent were assigned for area under a given crop. For variety, if high yielding variety is used, 1 point was assigned otherwise, 0 point. In the case of FYM, fertilizers and plant protection measures 3 points for 75 to 99 per cent, 2 points for 50 to 74 per cent, 1 point for 25 to 49 per cent and 0 point for less than 25 per cent of the recommended dose were assigned. For seed rate for recommended level 2 points for more/less than the recommended level, 1 point was assigned. Thus, points obtained for all the crops for all the above inputs together were assigned and they were equated to 100 and the technology adoption index in terms of percentages was worked out.

#### Resource use pattern, costs and returns

Per hectare input use levels and output produced of major vegetables and farm as a whole were estimated to know the differential in costs and returns for local and improved technology. The costs and returns of aggregate crop production activities as per hectare basis and farm as a whole were estimated. The simple method of tabular analysis was followed in estimation of costs and returns of individual farms. Cost A, Cost B and Cost C were estimated by following the standard cost concepts.

#### Production function analysis

The analysis of technological change was carried out most conveniently by the use of theory of production.

#### The Production Function Form

The production function describes the transformation of set of inputs to output. In general, the Cobb Douglas production function is written as

$$Y = aX_1^{b_1} X_2^{b_2} X_3^{b_3} \dots X_n^{b_n} e^n$$

Where,

$$Y = \text{Dependent variable}$$

$X_s$  = Independent resource variable

$a$  = Constant, representing intercept to production function

$b_s$  = Regression coefficient of the respective resource variable

## RESULTS AND DISCUSSION

### Adoption of Improved Vegetable Production

#### Technology of Sample Farms

Awareness about improved production technology is a pre requisite for its adoption, but the only awareness is not sufficient for adoption. The next step to awareness is acceptance by the vegetable growers followed by acquisition of required inputs and actual use as per the recommendation. The information on level of adoption of improved vegetables production technology by the vegetable farms is presented in Table 1. The level of adoption of improved vegetable production technology with respect to variety, seed rate, FYM application, fertilizer use and plant protection measures of major vegetables viz; onion, tomato, chilli, brinjal and okra grown in Maharashtra revealed that the adoption rate of improved variety above 75 per cent was found in case of 79.80, 99.17, 59.36, 47.37 and 50.54 per cent for onion, tomato, chilli, brinjal and okra, respectively and the adoption level of remaining vegetable growers was below 25 per cent. As regards the seed rate used the adoption rate was above 75 per cent in case of 91.92, 89.26, 83.56, 83.33 and 53.76 per cent of onion, tomato, chilli, brinjal and okra growers, respectively and the adoption level of remaining vegetable growers was below 25 per cent. The level of adoption above 75 per cent in case of FYM use was found in case of 24.28, 46.28, 31.96, 27.20 and 17.20 per cent of onion, tomato, chilli, brinjal and okra growers. The maximum number of vegetable growers' level of adoption of fertilizer application was in the range of 50 to 75 per cent i.e. 58.25, 44.63, 60.27, 59.65 and 64.52 per cent of onion, tomato, chilli, brinjal and okra growers, respectively. Similar trend was observed in adoption of plant protection measures. Similar observations reported by Balai *et al.* (2013) and Reddy & Turkey (2004).

#### Resource Use Structure of Selected Vegetables of Adopters and Non-adopters

##### Onion

The resource use structure of onion revealed that adopters have used maximum number of male and female labour (63.62 and 176.45 man days) as compared to non-adopters (56 and 156.16 man days respectively). Non adopters have utilized more bullock labour than the adopters. The non-adopters have used least seed (10.85 kg/ha) as compared to adopters (11.41 kg/ha.). The adopters have used maximum quantity of manures and it was four times more than non-adopters (11.62 qtls). As regards the fertilizers, adopters have used NPK fertilizers twice than non-adopters and the maximum quantity of nitrogenous fertilizers has been used as compared to phosphatic and potassic fertilizers. The adopters are nearer to recommended dose of fertilizer, however non

**Table 1: Adoption of improved vegetable production technology on vegetable farms**

Crop (N) technology	Level of adoption (Per cent)							
	Below 25		25-49		50-75		Above 75	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
<b>Onion</b>								
Variety	60	20.20	00	00	00	00	237	79.80
Seed rate	24	8.08	00	00	00	00	273	91.92
FYM	11	3.70	98	33.00	115	38.72	73	24.28
Fertilizers	00	0.00	37	12.46	173	58.25	87	29.29
Plant protection	53	17.84	74	24.92	143	48.15	27	9.09
<b>Tomato</b>								
Variety	1	0.83	0	0	0	0	120	99.17
Seed rate	13	10.74	0	0	0	0	108	89.26
FYM	14	11.57	17	14.05	34	28.10	56	46.28
Fertilizers	0	00	5	4.13	54	44.63	62	51.24
Plant protection	0	00	23	19.01	64	52.89	34	28.10
<b>Chilli</b>								
Variety	89	40.64	0	0	0	0	130	59.36
Seed rate	36	16.44	0	0	0	0	183	83.56
FYM	21	9.60	55	25.11	73	33.33	70	31.96
Fertilizers	0	0	39	17.81	132	60.27	48	21.92
Plant protection	33	15.07	78	35.62	98	44.75	10	4.56
<b>Brinjal</b>								
Variety	60	52.63	0	0	0	0	54	47.37
Seed rate	19	16.67	0	0	0	0	95	83.33
FYM	13	11.40	32	28.07	38	33.33	31	27.20
Fertilizers	0	0	16	14.03	68	59.65	30	20.32
Plant protection	21	18.42	39	34.21	47	41.23	07	6.14
<b>Okra</b>								
Variety	46	49.46	0	0	0	0	47	50.54
Seed rate	43	46.24	0	0	0	0	50	53.76
FYM	19	20.43	27	29.03	31	33.34	16	17.20
Fertilizers	0	0	4	4.30	60	64.52	29	31.18
Plant protection	10	10.75	35	37.63	42	45.16	6	6.46

adopters have used less than half of the recommended dose of fertilizers (Table 2)

**Tomato**

The maximum utilization of total human labour was noticed in case of adopters as compared to non-adopters. The utilization of female labour for farm operation was more in comparison with male labour in both the groups i.e. adopters and non-adopters. Highest number of bullock pair days (33.45) has been utilized by non-adopters over adopters (30.91). Non adopters utilized least quantum of seed (0.49 kg/ha.) over adopters (0.66 kg/ha). The use of manure for production of tomato was very much essential. The adopters have used maximum manure (70.13 q/ha) than the non-adopters (23.27 q/ha). In respect of use of NPK fertilizers for tomato production, it is seen that maximum / higher dose of NPK / ha have been utilized by adopters over non adopters.

**Chilli**

The utilization of total human labour was

comparatively more in case of adopters than the non-adopters for chilli crop. In case of adopters, the maximum number of female labour was used than male labour. Similar trend also have been observed in case of non-adopters. There was no much more difference in between adopters and non-adopters, for utilization of bullock pairs. Recommended seed rate of chili have been utilized by adopters than the non-adopters who have used seed rate below one kg/ha. The adopters have used the manure @ 54.49q/ha which was double than the non-adopters. In general, adopters have used maximum quantity of NPK/ha than the recommended dose and non-adopters have used the fertilizers less than the recommended dose.

**Brinjal**

It is revealed that, non-adopters have used more number of human labour than the adopters. The maximum number of female labour were used for cultivation of brinjal than male labour. The adopters have used maximum bullock labour than non-adopters. The seed

rate used by adopters was more in comparison with non-adopters. The non-adopters used least manure than adopters (21.59 q/ha). The utilization of NPK / ha was found more in case of adopters than non-adopters.

#### Okra

The adopters have utilized the maximum human labour than non-adopters. In general, maximum number of female labour were utilized than male labour in case of adopters and non-adopters. Maximum bullock labour have been utilized by non-adopters than the adopters. Among the adopters and non-adopters, the utilization of bullock labour was on par. Adopters have used maximum quantity of seed than non-adopters, however non adopters have used more manure (46.16q/ha) than adopters. Adopters have used maximum NPK/ha than non-adopters.

#### Cost of Cultivation and Returns of Major Vegetables Grown on Sample Farms

The cost of cultivation per hectare and returns of onion, tomato and chilli, are presented in Tables 3 and that of brinjal and okra in Tables 4.

#### Onion

The cost of cultivation of improved onion production technology in case of adopters and non-adopters was ₹40068.14/ha and ₹27449.97/ha., respectively, indicating additional expenses of ₹12618.17 for technology inputs at the overall level. The share of human labour in Cost 'C' was 21.15 per cent for adopters and 27.27 per cent for non-adopters.

The average gross returns of onion were ₹176802/ha

for adopters and ₹106230/ha for non-adopters. The net returns ranged from ₹136734 for adopters to ₹78781 per hectare for non-adopters. The B: C ratio ranged from 4.41 for adopters to 3.87 for non-adopters.

#### Tomato

The **per hectare** cost of cultivation of improved tomato production technology in case of adopters and non-adopters was ₹67251.76 and ₹50929.92, respectively, indicating additional expenses of Rs.16321.84 for technology inputs at the overall farm size level. The share of human labour in Cost 'C' was 19.41 per cent for adopters and 21.68 per cent for non-adopters. The average gross returns of tomato were ₹1,67,389/ha for adopters and Rs.1,03,427/ha for non-adopters. The net returns ranged from ₹1,00,138/ha for adopters and ₹52,498/ha for non-adopters. The B: C ratio ranged from 2.49 for adopters to 2.03 for non-adopters

#### Chilli

The per hectare cost of cultivation of improved chilli production technology in case of adopters and non-adopters was ₹46208.31 and ₹31989.74, respectively, indicating additional expenses of ₹14218.57 for technology inputs at the overall farm size level. This also, spells out that, there is potential of employment opportunities with adoption of improved production technology. The average gross returns of chilli were ₹152280/ha for adopters and ₹97794/ha for non-adopters. The net returns was ₹106072/ha for adopters and ₹65805/ha for non-adopters. The B: C ratio ranged from 3.29 for adopters and 3.07 for non-adopters

**Table 2: Resource use structure of selected vegetables on sample farms**

(Ha)

Technology	Vegetable crop									
	Onion		Tomato		Chilli		Brinjal		Okra	
	Adopters	Non adopters	Adopters	Non adopters	Adopters	Non adopters	Adopters	Non adopters	Adopters	Non adopters
Total human labour (days)	63.62	56.00	93.50	74.91	56.35	48.63	63.24	58.46	73.79	58.42
male										
Female	176.45	156.16	279.41	243.27	200.99	197.09	214.45	234.46	194.39	187.63
Bullock labour (Pair days)	8.73	11.48	30.91	33.45	19.93	19.81	31.51	20.18	23.96	25.26
Seed (kg)	11.41	10.85	0.66	0.49	1.12	0.89	0.64	0.45	12.32	9.89
Manure (qtls)	49.59	11.62	70.13	23.27	54.49	24.79	51.55	21.59	38.75	48.16
Fertilizer (kg) N	89.72	49.93	257.23	138.91	89.23	57.75	81.77	63.71	87.86	60.26
P	40.22	23.40	116.29	78.55	40.66	27.23	41.48	32.21	43.70	32.10
K	39.92	23.40	112.08	70.55	40.34	26.48	40.62	28.32	42.40	30.50

**Table 3: Per hectare cost of cultivation of onion, tomato and chilli**

Items of cost	Onion				Tomato				Chilli			
	Adopters		Non-Adopters		Adopters		Non-Adopters		Adopters		Non-Adopters	
	Cost	Per cent	Cost	Per cent	Cost	Per cent	Cost	Per cent	Cost	Per cent	Cost	Per cent
Cost 'A'	21597.82	53.90	14154.79	51.57	46085.29	68.53	32102.73	63.03	30003.05	64.93	17127.66	53.54
Cost 'B'	38087.34	95.06	24024.47	87.52	62740.06	93.29	44635.52	87.64	42744.21	92.50	26658.84	83.33
<b>Family labour charges</b>												
Cost 'C'	40068.14	100.00	27449.97	100.0	67251.76	100.0	50929.92	100.0	46208.31	100.0	31989.74	100.00
Gross returns	176802		106230		167389		103427		152280		97794	
Net profit	136734		78781		100138		52498		106072		65805	
B:C ratio	1:4.41		1:3.87		1:2.49		1:2.03		1:3.29		1:3.07	

**Table 4: Per hectare cost of cultivation of brinjal and okra**

Items of cost	Brinjal				Okra			
	Adopters		Non-Adopters		Adopters		Non-Adopters	
	Cost	Per cent	Cost	Per cent	Cost	Per cent	Cost	Per cent
Cost 'A'	22608.53	57.16	12846.94	46.92	25458.55	61.66	21804.93	60.98
Cost 'B'	36502.13	92.29	22228.06	81.19	35609.77	86.25	29609.41	82.81
Cost 'C'	39552.83	100.00	27377.70	100.00	41286.17	100.00	35756.71	100.00
Gross returns	124863		79821		154367		113654	
Net profit	85311		52444		113081		77898	
B:C ratio	1:3.16		1:2.91		1:3.74		1:3.18	

### Brinjal

The cost of cultivation of improved brinjal production technology in case of adopters and non-adopters was ₹39552.83/ha and ₹27377.70/ha, respectively, indicating additional expenses of ₹12175.13/ha for technology inputs at overall farm size level. The additional expenses per hectare for technology adoption at working cost level consist of plant protection (₹3171.55), manure (per hectare 1559.62), fertilizer (₹642 per hectare), seed (₹348.93 per hectare), etc. In the case of human labour use, increase in hired component by per hectare 1737.70/ha and decline in family labour by per hectare ₹099/ha was notable indicating rush for particular operation. This also, spells out that, there is potential of employment opportunities with adoption of improved production technology. The share of human labour in Cost 'C' was 24.26 per cent for adopters and 27.67 per cent for non-adopters. The average gross returns of brinjal were per hectare ₹124863/ha for adopters and ₹79821/ha for non-adopters. The net returns was per hectare 85311/ha for adopters and per hectare ₹52444/ha for non-adopters (Table 4).

### Okra

The cost of cultivation of improved okra production

technology in case of adopters and non-adopters was per hectare ₹41286.17/ha and per hectare ₹35756.71/ha respectively, indicating additional expenses of per hectare ₹5529.46/ha for technology inputs at overall farm size level. The share of human labour in Cost 'C' was 22.81 per cent for adopters and 25.68 per cent for non-adopters. The average gross returns of okra were per hectare ₹154367/ha for adopters and ₹113654/ha for non-adopters. The net returns was per hectare ₹113081/ha for adopters and per hectare ₹77898/ha for non-adopters. The B: C ratio was 3.74 for adopters and 3.18 for non-adopters.

### Production Function Analysis

The results of production function analysis for adoption of improved production technology of selected are presented in Table 5 and 6. The results are described below.

### Onion

The total variation in yield of onion explained by the variables included in the model for non-adopters was 88 per cent followed by 87 per cent in case of adopters. The coefficients of area, manure, phosphate fertilizer, potash fertilizer and technology adoption ( $X_1, X_4, X_6, X_7,$  and  $X_9$ )

Table 5: Results of production function of onion, chilli and brinjal

Categories of sample households	Area under crop (ha)	Human labour man days	Bullock labour pair days	Manure Qtls.	Fertilizers (Kg)			Plant Protection $\bar{x}$	Tech. adoption index	R <sup>2</sup>
					N	P	K			
	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>	X <sub>6</sub>	X <sub>7</sub>	X <sub>8</sub>	X <sub>9</sub>	
<b>Onion</b>										
Adopters	1.0546 ** (0.1686)	-0.2120 (0.15982)	-0.0170 (0.0188)	0.0048* (0.0021)	-0.0177 (0.0856)	0.0587 *(0.0308)	-0.0344 * (0.0168)	-0.0090 (0.0461)	0.8876** (0.4178)	0.87
MVP	-142109.6	-77.637	-17.1612	2.6304	-7.5519	30.7483	-18.5143	-2.3676	--	--
Non-adopters	3.8371 (2.6590)	0.0031 (0.2513)	0.2104** (0.0657)	0.6489** (0.1919)	-9.7088 (8.2012)	0.2345 (0.1920)	9.8905* (8.3173)	-0.0290 (0.0810)	0.6296*** (0.3137)	0.88
MVP	20750.28	0.9001	131.35	242.68	-4579.94	110.62	-62075.74	-1678.15	--	--
<b>Chilli</b>										
Adopters	0.8184*** (0.0864)	-0.4145 (0.1018)	0.0054 (0.013743)	0.0151** (0.00914)	0.2475** (0.1177)	0.1272 (0.7143)	0.1897 (0.3455)	0.0938*** (0.0351)	0.9836** (0.4288)	0.85
MVP	987.1215	-220.3687	8.36727	12.98549	168.122	118.3623	176.8227	28.792	--	--
Non-adopters	0.8639*** (0.3499)	0.1386 (0.2770)	-0.0114 (0.6561)	0.5015* (0.3341)	0.0058 (0.0148)	0.0488** (0.0273)	0.2669** (0.1134)	0.2644 (0.5117)	1.3276*** (0.4377)	0.77
MVP	692.911	59.1770	-14.2955	376.453	39.4304	32.7576	330.099	332.508	--	--
<b>Brinjal</b>										
Adopters	0.7372** (0.1211)	0.0986** (0.1233)	-0.1414** (-0.0496)	0.0027 (0.0060)	0.1343 (0.1080)	-0.3857 (-0.1822)	0.4315 (0.1472)	0.1580** (0.0411)	0.8283** (0.4117)	0.91
MVP	-855.447	50.604	-151.0465	3.5477	92.0925	-350.845	397.0218	46.9844	--	--
Non-adopters	0.8505** (0.348)	1.5905 (1.3108)	-0.1698 (0.1441)	0.0021 (0.0171)	-0.01684 (0.0384)	0.04285 * (0.0205)	0.0263** (0.0123)	---	1.0276*** (0.3876)	0.87
MVP	-877.959	684.54	-187.0461	-8.9263	-11.8989	69.2958	60.98013	----	--	--

Table 6: Results of production function of okra and tomato

Categories of sample households	Fertilizers (kg)										Tech. adoption index	R <sup>2</sup>
	X <sub>1</sub>	X <sub>2</sub>	X <sub>3</sub>	X <sub>4</sub>	X <sub>5</sub>	X <sub>6</sub>	X <sub>7</sub>	X <sub>8</sub>	X <sub>9</sub>	X <sub>10</sub>		
<b>Okra</b>												
Adopters	1.2648*** (0.1509)	-0.0053 (0.0179)	0.7175* (0.0416)	-0.2421 (0.1409)	0.0060 (0.0032)	0.0091 (0.0500)	0.0315 (0.1020)	-0.0583 (0.0901)	0.0271 (0.0489)	0.8832* (0.5372)	0.89	
MVP	-987.68	-2.6286	83.272	-593.86	15.0014	5.4107	25.339	-47.651	6.5965	--	--	
Non-adopters	0.8031* (-0.3291)	0.3763** (0.1331)	0.0737* (0.0339)	-0.1224 (0.1379)	-0.0064 (0.0135)	-0.0046 (0.0267)	0.2373* (0.11)	-0.2169 (0.3480)	0.0073 (0.0137)	1.1262** (0.5216)	0.91	
MVP	-464.45	138.8688	74.1601	-586.23	-7.3405	-14.621	-633.01	543.50	1.834428	--	--	
<b>Tomato</b>												
Adopters	0.4956** (0.0622)	-0.1212 (0.0690)	-0.0023 (0.0350)	0.0043 (0.0045)	0.0111 (0.0367)	0.1247 (0.1112)	-0.1267 (0.1102)	0.2434** (0.0318)	0.2928** (0.0333)	0.6811** (0.3287)	0.92	
MVP	-716.30	-57.1454	-2.3411	4.2900	6.3070	95.006	-97.396	71.115	73.513	--	--	
Non-adopters	15.3576** (4.7210)	-1.2744* (0.5271)	26.8937** (7.3206)	-0.0074 (0.0123)	0.0784 (0.2680)	-0.2624** (0.0671)	0.2516** (0.0671)	-0.4222** (0.1239)	-6.5104** (1.7640)	0.5286*** (0.2339)	0.96	
MVP	-12703.27	-491.90	21885.07	31.273	3950.97	-433.92	861.82	-194.37	-1242.45	--	--	

\*,\*\* and \*\*\* indicates significance at 10,5 and 1 per cent level, respectively  
 Figures in brackets are the standard errors to respective regression coefficients

recorded positive values for technology adopter farms means increase in the use of these inputs would result in better yield. Among the significant variables, only phosphatic fertilizers ( $X_6$ ) recorded positive marginal value product indicating economic potential for expanding its use in order to increase the production of onion in case of adopters. In case of non-adopters, coefficients of area, bullock labour, manure, and phosphate fertilizer ( $X_1$ ,  $X_3$ ,  $X_4$  and  $X_6$ ) recorded positive values of marginal value product.

#### Chilli

The value of  $R^2$  in chilli production was 85 per cent indicating appropriate selection of variables in the present model for adopters and it was 77 per cent for non-adopters. The coefficients of variables -area, manure, nitrogenous fertilizer, plant protection and technology adoption ( $X_1$ ,  $X_4$ ,  $X_5$ ,  $X_8$  and  $X_9$ ) recorded significant positive value, however remaining variables were found non-significant. The coefficients of area, nitrogenous fertilizer and technology adoption were positive for adopters. In case of non-adopters, coefficients of area, manure, phosphate fertilizer, potash fertilizer and technology adoption ( $X_1$ ,  $X_4$ ,  $X_6$ ,  $X_7$ , and  $X_9$ ) recorded positive values. The value of  $R^2$  for the adopters was 85 per cent. Whereas, the significant variables include area, manure, nitrogenous fertilizer and technology adoption. In addition to, these phosphate fertilizer showed significant coefficient. Among the significant variables, only area, manure and technology adoption, ( $X_1$ ,  $X_4$  and  $X_9$ ) recorded positive marginal value product indicating economic potential for expanding the respective resource use in order to increase the production.

#### Brinjal

The value of  $R^2$  was 91 per cent indicating total variation in yield of brinjal explained by the variables included in the present model for adopters followed by 87 per cent for non-adopters. The coefficients of area, human labour, plants protection and technology adoption ( $X_1$ ,  $X_2$ ,  $X_8$  and  $X_9$ ) for adopters, recorded significant positive values indicating potential for additional use towards optimization. In case of non-adopters, area, phosphate fertilizer, potash fertilizer and technology adoption ( $X_1$ ,  $X_6$ ,  $X_7$ , and  $X_9$ ) recorded positive values, indicating economic potential for expanding the use of phosphate fertilizer and potash fertilizer for non-adopters and plant protection for adopters.

#### Okra

The value of  $R^2$  was 89 per cent for adopters indicating appropriate selection of variables for the present model and for non-adopters was 91 per cent. The variables like area and technology adoption ( $X_1$ , and  $X_{10}$ ) recorded positively significant values adopters, however others were non-significant. In case of non-adopters, coefficients of human labour, bullock labour and technology adoption ( $X_2$ ,  $X_3$ , and  $X_{10}$ ) recorded significant positive values. The coefficients of seed found negative

but non-significant. It may due to non-adoption of recommended seed rate.

#### Tomato

The coefficients of variables like area, plant protection, staking charges and technology adoption ( $X_1$ ,  $X_8$ ,  $X_9$  and  $X_{10}$ ) recorded significant positive values, however remaining were non-significant. It has been observed that coefficients of area, nitrogenous fertilizer and technology adoption were positive in case of adopters. In case of non-adopters, coefficients of area, bullock pair, potash fertilizer and technology adoption ( $X_1$ ,  $X_3$ ,  $X_7$ , and  $X_{10}$ ) recorded positive values but negative marginal value product.

#### CONCLUSIONS

1. The level of adoption > 75 per cent of improved varieties was nearly 50 to 75 per cent, of seed rate 54 to 92 per cent and of FYM was only 17.20 to 46.28 per cent of vegetable growers. The maximum number of vegetable growers' level of adoption of fertilizer application and plant protection was in the range of 50 to 75 per cent. This suggests that there is a need to educate the vegetable growers by the extension agencies for adoption of recommended doses of fertilizer application and to popularize the use of plant protection measures by conducting the result demonstrations.
2. The cost of cultivation of major vegetables in case of adopters of improved vegetable production technology was relatively more than the non-adopters but the return structure i.e. profit earned of adopters was far better than the non-adopters. Thus, the adoption of improved vegetable production technology has played a very significant role in improvement of productivities of vegetables grown in Maharashtra which needs to be popularized with suitable location specific modification made.
3. The results of production function analysis for selected vegetable crops, chilli, okra, brinjal, onion and tomato indicated that the total variation explained by the variables ranged from 85 to 92 per cent for adopters and 77 to 96 per cent for non-adopters. The significant positive coefficients showed potential for area expansion, and technology adoption for above vegetable crops.

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## Marketable Surplus and Price Spread of Potato in Uttarakhand

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### ABSTRACT

The study was carried out in 2011 to assess production, market arrival, cost, price spread and efficiency of Potato in U.S Nagar District. The marketable surplus was 87.15 per cent after retaining 2.68 per cent for home consumption. The marketed surplus is higher for small farmers (90.12 per cent). It revealed that fewer requirements of small farmers than other category farmers were due to their immediate cash requirement. The most prominent marketing channel for Potato was Channel-I (59.23 per cent). The producers share in consumers' rupee was highest (92.77 per cent) in Channel-III. The share of producer's marketing cost of the channel was 46.06 per cent in Channel-I. The high marketing costs lead to the decrease in the marketing efficiency of the channel which was only 0.48 in the Channel-I. Besides high costs, the high retailer's margin was also the cause of lower marketing efficiency. The producers share in consumers' rupee was highest in Channel-III (92.77 per cent) and the lowest was in Channel-I (38.38 per cent). Marketing efficiency ratio was found to be highest (12.83) in Channel-III.

### Keywords

Marketing efficiency, marketable surplus, price spread

### JEL Codes

C82, M31, O13, Q13, Q18

### INTRODUCTION

Potato is the most important non-cereal food crop of the world. Potatoes are grown in about 150 countries in the world with a production of around 364.808 tons in the year 2012 (Anonymous, 2014). The state of Uttarakhand is important in respect of potato cultivation in the country. The productivity of potato is 22.4 t/ha in the state according to data furnished by Directorate of Horticulture and food processing, Chaubatia, Uttarakhand during the year 2010-11. Potato is a prime crop in the state as it is a good source of income and employment generation. Kumaon region has produced more than 50 per cent of total production of potato in the state in year 2010-11. Among 13 districts of Uttarakhand, Nainital district in Kumaon region accounts for the highest production of potatoes in the state followed by Udham Singh Nagar (Anonymous, 2011). Though the marketing system is more concerned with the surplus which enters the market, the quantum of total production is essential for this surplus because larger the production, larger will be the surplus (Sashimatsung *et al.*, 2013). Marketing of the surplus is crucial from the farmer's point of view. The net return to the farmers from the sale of its product through

different marketing channels will determine the efficiency of the marketing system in the market. Unless marketing efficiency improves, cultivators will not be attracted to increase production. Higher share in consumer's rupee and attractive terms of trade will motivate the farmers for commercial production of potato. The present study has been designed with the following specific objectives:

- to estimate production, farm level retention, marketable and marketed surplus of potato,
- to study the marketing channels and to analyze the marketing cost and price spread in marketing of
- potato, and
- to analyze the marketing efficiency for potato.

### METHODOLOGY

#### Selection of Sample

Udham Singh Nagar district was purposively chosen due to highest production of potato among all districts. Kashipur and Bazpur having highest total cropped area and production under potato crop were selected purposively. Out of each block, three potato producing villages were selected randomly viz., Parmanandpur,

Basai Majhra and Shivalpur, from Kashipur block and Chakarpura, Khamaria and Laddhupur, from Bazpur block. Then from the list of potato growing farmers 15 farmers from each village were selected randomly. Thus, in all 90 potato growers comprising of, 32 small, 45 medium and 13 large farms were selected for the detailed inquiry. The collection of information is based on a structured questionnaire designed to collect relevant information on land holding, production, farm level retention, marketable surplus, marketed surplus, losses, marketing facilities etc. The primary data relating to market arrival, cost and price spread by different marketing agencies was collected for the year 2011-12.

**Tools Used**

**Marketable and marketed surplus:** The marketable surplus was worked out by subtracting the requirement for family consumption, seed, and laborer etc from the total production of the crop on the farms. Symbolically,

$$MS = P - C$$

Where,

MS = Marketable surplus,

P = Total production, and

C = Total requirements.

The marketed surplus is the quantity of produce which the farmer actually sells in the market irrespective of his requirements for family consumption, farm needs, feeds and others.

Marketing cost (assembling, transport, packing, market fees, labour, loading, unloading, tax, losses) at various level of potato marketing was calculated.

**Marketing margin at each stage of marketing is calculated as:**

$$MM = SP - (PP + MC)$$

Where, MM= Marketing margin of ith middlemen

SP= Sale Price of ith middlemen

PP= Purchase price of ith middlemen

MC = Marketing cost at each stage of marketing

**The producer's price is worked out as:**

$$PF = SP - MC$$

Where, PF = Producer's price

SP = Sale price of producers

MC = Marketing cost of producers

**Producer's share in consumers Rupee is worked out as:**

$$PS = (PF / RP) \times 100$$

Where, PS = Producer's share

RP = Retail price

**The marketing efficiency (ME) is worked out applying Acharya's formula**

$$ME = PF / (MC + MM)$$

MC = Total marketing cost

MM = Total net margins of middle men

PF = Producer's price

**RESULTS AND DISCUSSION**

**Production, Farm Retention and Marketed Surplus**

Marketed surplus may be more, less or equal to marketable surplus because of cash requirement,

hoarding or perishable nature. The overall production of potato was 340.17 quintals (Table 1) of which marketable surplus was 296.46 quintals (87.15 per cent) after retaining 9.13 quintal (2.68 per cent) for home consumption, 4.66 quintal is kept as seed and 22.08 quintal as wages in kind. Marketed surplus was 288.63 quintal (84.84 per cent) and losses due to mishandling, breakage and spoilage accounted 2.30 per cent of total quantity.

**Table 1: Production, marketed and marketable surplus of potato for selected farmers**

Particulars	(q)			
	Small farmers	Medium farmers	Large farmers	Total
Production of potato	148.62 (100)	295.41 (100)	576.50 (100)	340.17 (100)
Home consumption	3.86 (2.59)	7.78 (2.63)	15.76 (2.73)	9.13 (2.68)
Wage in Kind	4.25 (2.85)	15.50 (5.24)	46.50 (8.07)	22.08 (6.49)
Seed requirement	2.63 (1.76)	3.86 (1.30)	7.50 (1.03)	4.66 (1.37)
Spoiled	1.97 (1.32)	8.96 (3.03)	12.56 (2.17)	7.83 (2.30)
Total (2+3+4)	10.74 (7.22)	27.14 (9.18)	69.76 (12.10)	35.88 (10.54)
Marketable surplus	135.91 (91.44)	259.31 (86.73)	493.94 (85.67)	296.46 (87.15)
Marketed surplus	133.94 (90.12)	250.35 (84.74)	481.38 (85.67)	288.63 (84.84)

Figure in parentheses is in percentage to production

**Marketing Channels**

Marketing channels indicate how market intermediaries are set to accomplish the movement of a product from producer to the final consumer. Three marketing channels were identified in the study area for marketing of potato.

Channel-I: producer-wholesaler-retailer-consumer

Channel-II: producer-retailer/shopkeeper- consumer

Channel-III: producer-consumer.

Table 2 presents total quantity marketed through the identified marketing channels. It is observed from the table that out of the total quantity of potato 865.67 quintals is marketed, Channel-I is the most prominent marketing channel for potato through which small, medium and large farmers marketed 58.22, 62.35 and 57.90 per cent respectively. For all farms, the maximum quantity of potato was passed through Channel-I (59.23 per cent) followed by Channel-III (22.69 per cent) and Channel-II (18.08 per cent) . The study shows that maximum number of farmers were using Channel-I.

**Marketing Cost**

The perusal of Table 3 shows the marketing cost of potato incurred by the producer was highest in Channel-

**Table 2: Marketing channels and sale pattern of potato (q)**

Category	Channel-I	Channel-II	Channel-III	Total
Small	77.97 (58.22)	23.49 (17.54)	32.60 (24.34)	133.94 (100)
Medium	156.09 (62.35)	41.33 (16.51)	52.92 (21.14)	250.35 (100)
Large	278.71 (57.90)	91.70 (19.05)	110.95 (23.05)	481.38 (100)
Total	512.77 (59.23)	156.52 (18.08)	196.47 (22.69)	865.67 (100)

Figure in parentheses indicates percentage to the total

**Table 3: Marketing cost incurred under different marketing channels (₹/q)**

Intermediaries	Channel-I	Channel-II	Channel-III
Producers	97.9 (46.06)	106.01 (68.65)	56.42 (100)
Retailers	69.64 (32.77)	48.41 (31.34)	-
Wholesalers	44.97 (21.16)	-	-
Total marketing cost	212.51 (100)	154.42 (100)	56.42 (100)

Figure in parentheses indicates percentage to the total

III (Rs. 56.42/quintal) followed by Channel-II and I. The marketing cost incurred by producer is low in channel first because the produce was transported in large quantities which result in low cost of transportation. Chole *et al.* (2003) also reported low marketing cost (21.84 per cent) incurred by producer (Producer—Commission agent—Wholesaler—Retailer—Consumer) in marketing of brinjal in Maharashtra State. In the Channel-III, producers incurred all the expenses went through streets as vendors and sold the fresh potato directly to the consumers. In Channel-II, 31.34 percent to total cost was incurred by the retailers. In Channel-I, out of total cost (₹212.51/quintal) producers share in the cost was 46.06 per cent while the wholesalers and retailers contribute 32.78 and 21.16 per cent respectively.

**Marketing Margin and Price Spread**

Price spread is the difference on ultimate price paid by the consumer and the net price received by the producer for an equivalent quantity of farm product. It consists of marketing cost and margins of the intermediaries that determines the overall effectiveness of marketing system. Baba *et al.* (2010) also found that the net price received by the producers is relatively higher in the channels in which the produce is directly sold to the consumers or retailers. The perusal of Table 4 shows that producers share in consumers' rupee was highest in Channel-III (92.77 per

**Table 4: Price spread of potato under different marketing channels (₹/q)**

Particulars	Channel-I	Channel-II	Channel-III
Net price realized by producers	475.40 (38.38)	756.29 (73.54)	724.03 (92.77)
Net Margin of wholesaler	220.28 (17.78)	-	-
Net margin of retailers	329.81 (26.62)	117.69 (11.44)	-
Total marketing cost	212.51 (17.15)	154.42 (15.01)	56.42 (7.22)
Total costs and margins	762.6 (61.57)	272.11 (26.45)	56.42 (7.22)
Consumers purchase price	1238.55 (100)	1028.40 (100)	780.45 (100)
Producers' share in consumer's rupee	38.38	76.19	92.77

Figure in parentheses indicates percentage to consumers' rupee

cent) and lowest in Channel-I (38.38 per cent). Larger share of producer in Channel-III are due to the absence of any middlemen between producers and consumers.

Next profitable channel of producers for sale of Potato was through retail market (Channel-II, 76.19 per cent). Producers share is directly related to the number of market intermediaries involved in the marketing of potato as revealed by the table-5. The net margin of wholesaler and retailer was 17.78 and 26.62 per cent respectively (Channel-I) while the share of retailer in consumers rupee was 11.44 percent (Channel-II). The retailer have higher margin than the wholesalers.

**Marketing Efficiency**

In the present study the marketing efficiency was measured in the selected channels by using Acharya & Agarwal (2001). The marketing efficiency is presented in Table 5. The marketing efficiency in Channel-I, II and III is 0.48, 1.77, and 12.83, respectively. The high ratio indicates that Channel-III is the most efficient marketing channel of potato which is followed by Channel-II. The study depicts that higher marketing margins pocketed by the intermediaries resulted in poor marketing efficiency of potato.

**Table 5: Marketing efficiency for potato under different marketing channels (₹/q)**

Particulars	Channel-I	Channel-II	Channel-III
Net Price received by the farmers	475.40	756.29	724.03
Total marketing cost	212.51	154.42	56.42
Total net margins of intermediaries	762.6	272.11	56.42
Marketing efficiency(ratio)	0.48	1.77	12.83

## CONCLUSION AND SUGGESTIONS

The study concludes that small farmers marketed 133.94 quintals (90.12 per cent); medium, 250.35 quintals (84.74 per cent); large 481.38 quintals (85.67 per cent) of their total production. Percentage loss due to breakage and spoilage was high among the medium farmers. The study also shows that major portion of marketable surplus was transacted through Channel-I (59.23 per cent). The least was recorded in Channel-II (18.08 per cent). In the marketing of potato, producer-consumer (Channel III) is the most efficient channel in the study area whereas Channel-I recorded the lowest efficient marketing channel. Lower the market efficiency, poorer the marketing system. To minimize post-harvest losses, proper storage facilities need to be established in the production area. Wooden/plastic crates at low price will help to reduce packing cost and losses due to mishandling, and breakage. High market margin of retailer (26.62 per cent) and wholesaler (17.78 per cent) shows how inefficiency is in the marketing of potato in the study area. This is because of its perishable nature with no better storage infrastructure and market operation on the part of the farmers, a reason of fear that gives advantage to the

intermediaries and another reason are lack of/non coordination among the concern farmers. Establishing co-operative societies and collective decision among farmers relating to price and arrival will help to reduce the gross market margin.

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## Casualty between Cotton Area and Sesamum Area in Andhra Pradesh State- An ARDL Bounds Testing Approach

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### ABSTRACT

This paper empirically investigates cotton area casualty between sesamum for Andhra Pradesh by using the annually time series data during the period 1995-2012. Research variables are sesamum area, farm harvest price of cotton, farm harvest price of sesamum. Long-run and short-run elasticities of variables were examined using the bounds testing cointegration. The autoregressive distributed lag model (ARDL) demonstrates that there is a long-term relationship between the variables like cotton area and sesamum area. CUSUM and CUSUMSQ stability tests on hypothesized cotton area function were also implemented.

### Keywords

Bounds test, cointegration, cotton area, sesamum area

### JEL Codes

Q10, Q12, Q11, Q13, Q19

### INTRODUCTION

Cotton is the most important fibre crop not only of India but of the entire world. It provides the basic raw material (cotton fibre) to cotton textile industry. Andhra Pradesh economy is mainly based on agriculture and livestock. Four important rivers of India, the Godavari, Krishna, Penna, and Thungabhadra flow through the state and provide irrigation. 60 percent of population is engaged in agriculture and related activities. Its seed (binola) is used in vanaspati industry and can also be used as part of fodder for milch cattle to get better milk.

#### Conditions of Growth

Cotton is the crop of tropical and sub-tropical areas and requires uniformly high temperature varying between 21°C and 30°C. The growth of cotton is retarded when the temperature falls below 20°C. Frost is enemy number one of the cotton plant and it is grown in areas having at least 210 frost free days in a year. The modest requirement of water can be met by an average annual rainfall of 50- 100 cm. However, it is successfully grown in areas of lesser rainfall with the help of irrigation. About one-third of the total area under cotton cultivation is irrigated.

#### Types of Cotton

Three broad types of cotton are generally recognised

on the basis of the length, strength and structure of its fibre.

#### Long staple cotton

It has the longest fibre whose length varies from 24 to 27 mm. The fibre is long, fine and shining. It is used for making fine and superior quality cloth. Obviously, it fetches the best price. There has been rapid progress in the production of long staple cotton since Independence. About half of the total cotton produced in India is a long staple. It is largely grown in Punjab, Haryana, Maharashtra, Tamil Nadu, Madhya Pradesh, Gujarat and Andhra Pradesh.

#### Medium staple cotton

The length of its fibre is between 20 mm and 24 mm. About 44 per cent of the total cotton production in India is of medium staple. Rajasthan, Punjab, Tamil Nadu, Madhya Pradesh, Uttar Pradesh, Karnataka and Maharashtra are its main producers.

#### Short staple cotton

This is inferior cotton with fibre less than 20 mm long. It is used for manufacturing inferior cloth and fetches lower price. About 6 per cent of the total production is of short staple cotton. U.P., Andhra Pradesh, Rajasthan, Haryana and Punjab are its main producers.

## Distribution

India has the sole distinction of growing all the four cultivated species of cotton and their intra- and inter-specific hybrids. In India, cotton is grown in three distinct agro-ecological zones, viz., Northern (Punjab, Haryana and Rajasthan), Central (Gujarat, Maharashtra and Madhya Pradesh) and Southern zone (Andhra Pradesh, Tamil Nadu and Karnataka).

### Andhra Pradesh

Andhra Pradesh accounts for 12.46 per cent of production and 10.47 per cent of hectareage of India. Two-thirds of the production of Andhra Pradesh comes from two districts, namely Guntur and Prakasam. Adilabad, Kurnool and Anantapur contribute the rest.

## METHODOLOGY

The most popular single equation testing for co-integration between a set of  $I(1)$  variables relied on the Engle & Granger (1987); Phillips & Ouliaris (1990) residual based tests. Also Hansen's instability test (1995), Park's added variables test (1992) and the stochastic common trends approach of Stock & Watson (1988) are well known. System co-integration testing is mostly based on Johansen's (1991) system based reduced rank approach. Recently, also the so called Autoregressive Distributed Lag (ARDL) test is found in applied empirical papers. This test is based on Pesaran *et al.* (2001). This technique is reported to offer several advantages. The test is based on a single ARDL equation, rather than on a VAR as in Johansen, thus reducing the number of parameters to be estimated. Also unlike the Johansen approach the restrictions on the number of lags can be applied to each variable separately. The ARDL approach also does not require pre-testing for the order of integration (0 or 1) of the variables used in the model.

### Procedure

Pesaran, Shin and Smith (PSS 2001) developed a new approach to co-integration testing which is applicable irrespective of whether the regressor variables are  $I(0)$ ,  $I(1)$  or mutually co-integrated. The starting point of their test is a data generating process represented by a general VAR of order  $p$  which is rewritten in vector ECM form involving a vector  $z$  of variables. They focus on the conditional modeling of the dependent scalar variable  $y$ . To that end, the vector  $z$  is partitioned into the scalar  $y$  and vector  $x$  of dependent variables. To test the absence of a level relationship between  $y$  and  $x$ , the approach uses a Wald or F-statistic to test for the joint hypothesis that all coefficients of all (lagged) levels in the ECM equation are zero. PSS distinguishes five cases according to how the deterministic components are specified: no intercepts, no trends; restricted intercepts, no trends; unrestricted intercepts, no trends; unrestricted intercepts, restricted trends; unrestricted intercepts, unrestricted trends.

The resulting conditional ECM's may be interpreted as autoregressive distributed models of orders  $(p, p, \dots, p)$ , i.e. ARDL  $(p, p, \dots, p)$  models. PSS publishes tabulated asymptotic critical value bounds for the F-statistic for all 5

conditional ECM models. If the computed F-statistic from exclusion of levels in the conditional EMS's fall outside the critical value bounds, the test allows a conclusive inference without needing to know the integration/cointegration status of the underlying regressors. But if the F-statistic falls inside the bounds, inference is inconclusive and knowledge of the order of integration of the underlying variables is required before conclusive inferences can be made. If the computed F-statistic lies below the 0.05 lower bound, the hypothesis that there is no level relationship is not rejected at the 5 percent level. If the statistic falls within the 0.05 bounds, the test is inconclusive and when the F-statistic lies above the 0.05 upper bound, the hypothesis of no level relationship is conclusively rejected. In addition to the F-test, PSS also tabulates asymptotic critical value bounds of the t-statistic for testing the significance of the coefficient on the lagged dependent variable in the conditional ECM. Concerning the use of the F and t-statistics, PSS suggests the following procedure: test  $H_0$  using the bounds procedure based on the Wald or F-statistic. If  $H_0$  is not rejected, proceed no further. If  $H_0$  is rejected test the coefficient of the lagged dependent variables using the bounds procedure based on the t-statistic. A large value of t confirms the existence of a level relationship between  $y$  and  $x$ .

### Modeling Procedure

Testing for the existence of a level relationship as in the previous section requires that the coefficients of the lagged changes remain unrestricted. But for the subsequent estimation of the ECM model, a more parsimonious approach is recommended, such as the ARDL approach to the estimation of the level relations discussed in Pesaran and Shin (1999). In practical terms an ARDL  $(p, p, \dots, p)$  model is selected from a broader search analysis testing the lag orders using information criteria such as AIC or SBC. In this respect, it is interesting that PSS note that the ARDL estimation procedure is directly comparable with the semi parametric Fully Modified OLS approach (FMOLS) of Phillips & Hansen (1990). From the parsimonious ARDL specification the specification of the estimated levels relationship is then derived, as well as the associated ECM model.

## RESULTS AND DISCUSSION

The result of the estimated coefficients of the short run relationship in Table 1 indicates that cotton price does not have significant influence on cotton area at 5 per cent probability level. Sesamum price was found to be not related to cotton area and also not significant in short run. Reports the Akaike (AIC) and Schwarz Bayesian (SBC) Information Criteria for all lags up to four.

### Estimated Long Run Relationship

The result of the estimated coefficients of the long run relationship in Table 2 indicates that cotton price has a positive and significant influence on cotton area at 5 per cent probability level. The estimated coefficient of cotton price (4.19) implies that 1 per cent increase in cotton price

will increase cotton area by approximately 4.19 per cent, all things being equal. Sesamum price was found to be negatively related to cotton area and significant at 10 per cent with an estimated coefficient of -2.90. This implies that Sesamum price a unit increase in will lead to a decrease of economic growth by a magnitude of 2.90.

**Co-integration**

In the Vector Error Correction Model (VECM) which

encompasses the long run equilibrium relationship between cotton area and sesamum area. That a long-run cointegrated relationship between cotton area and sesamum area exists is confirmed by the formal Johansen co-integration test reported in Table 2.

$$\text{Cointeq} = \text{AREA} - (4.1981 * \text{PRICE} - 2.9071 * \text{SSPRICE} - 7.7635)$$

**ARDL Bounds Test for Cointegration**

**Table 1: Descriptive of the ARDL Model**

Dependent Variable: AREA

Method: ARDL

Dependent lags: 2 (Fixed)

Dynamic regressors (2 lags, fixed): PRICE SSPRICE

Fixed regressors: C

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
AREA(-1)	-0.29946	0.276092	-1.08464	0.314
AREA(-2)	-0.15248	0.265177	-0.575	0.5833
PRICE	2.904671	1.58393	1.833838	0.1093
PRICE(-1)	2.662769	1.409421	1.889265	0.1008
PRICE(-2)	0.527904	1.098223	0.480689	0.6454
SSPRICE	0.612306	1.355985	0.451558	0.6652
SSPRICE(-1)	-0.67205	2.213669	-0.30359	0.7703
SSPRICE(-2)	-4.16122	1.822652	-2.28306	0.0564
C	-11.2722	5.416528	-2.08107	0.076
R-squared	0.601791	Mean dependent var		2.640536
Adjusted R-squared	0.146695	S.D. dependent var		0.583342
S.E. of regression	0.538859	Akaike info criterion		1.899596
Sum squared resid	2.032584	Schwarz criterion		2.334177
Log likelihood	-6.19677	Hannan-Quinn criter.		1.92185
F-statistic	1.32234	Durbin-Watson stat		1.727685
Prob(F-statistic)	0.36279			

**Table 2: Co-integration tests between cotton area and sesamum area**

ARDL Cointegrating and Long Run Form

Dependent Variable: AREA

Selected Model: ARDL(2, 2, 2)

**Cointegrating Form**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(AREA(-1))	0.152476	0.265177	0.574998	0.5833
D(PRICE)	2.904671	1.58393	1.833838	0.1093
D(PRICE(-1))	-0.5279	1.098223	-0.48069	0.6454
D(SSPRICE)	0.612306	1.355985	0.451558	0.6652
D(SSPRICE(-1))	4.161222	1.822652	2.283059	0.0564
CointEq(-1)	-1.45194	0.391263	-3.71089	0.0075

$$\text{Cointeq} = \text{AREA} - (4.1981 * \text{PRICE} - 2.9071 * \text{SSPRICE} - 7.7635)$$

**Long Run Coefficients**

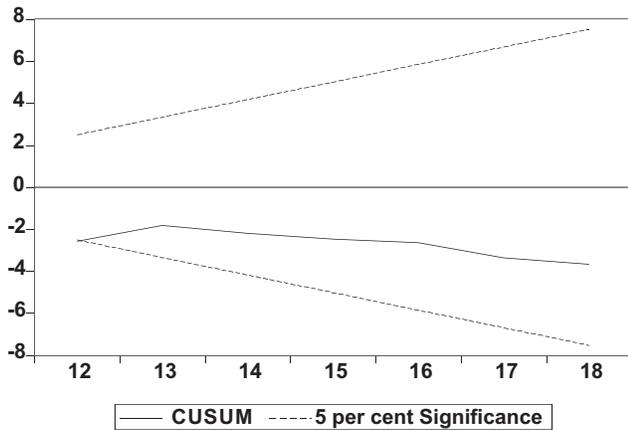
Variable	Coefficient	Std. Error	t-Statistic	Prob.
PRICE	4.198077	1.387603	3.025415	0.0192
SSPRICE	-2.90712	1.112736	-2.61259	0.0348
C	-7.76355	3.706513	-2.09457	0.0745

The computed F-statistics as shown in Table 3 is = 5.55. This value is above the upper bounds of the critical value of 4.85 at 5per cent level of significance. This implies that there is cointegration (long run relationship) between the cotton area and sesamum area. Hence the null hypothesis of no cointegration between the variables is rejected and the alternative hypothesis is accepted.

**Table 3: ARDL bounds test for cointegration**

ARDL Bounds Test		
Test Statistic	Value	k
F-statistic	5.551219	2
Critical Value Bounds		
Significance (per cent)	10 Bound	11 Bound
10	3.17	4.14
5	3.79	4.85
1	5.15	6.36

The cumulative sum (CUSUM) and cumulative sum of square (CUSUMQ) plots from a recursive estimation of the model is shown in Figures 1. This indicates stability in the coefficients over the sample period as the plot of the CUSUM statistic fall inside the critical bands of the 5per cent confidence interval of parameter stability.



**Figure 1: Test result for model stability (CUSUM Test)**

**CONCLUSIONS**

The ARDL estimation procedure is based on two basic steps. First, the existence of a level relationship is tested using an unrestricted ARDL specification. Secondly, when the existence of such a level relationship cannot be rejected, a more parsimonious ARDL lag model is selected using information criteria to determine the optimal lag orders of the independent variables in the ARDL equation. The second step involves the estimation of the conditional ECM model from which the cointegration vector and the short term dynamics can be obtained.

The results obtained in that report using the Johansen maximum likelihood cointegration test and the corresponding vector error correction estimation are broadly confirmed by the estimation of an ARDL (2, 2, 2) model. We can conclude that as increasing. Furthermore the results from the ARDL approach are very much in line with those obtained using Phillips and Hansen's Fully Modified OLS.

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## Study of Economics of Paddy Cultivation Under Transplantation, System of Rice Intensification (SRI) and Direct Seeding in Warangal District of Andhra Pradesh

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### ABSTRACT

This study compares the costs and returns of paddy farms under SRI, transplantation and direct seeding methods. A pre-tested schedule was used to collect data through survey method related to the rabi season. The study was based on input-output data from 90 sample paddy farmers i.e., 30 each adopting transplantation, SRI and direct seeding methods were selected randomly in Warangal district of Andhra Pradesh. The Cobb-Douglas production function analysis indicated increasing returns to scale in SRI ( $b_i = 1.0821$ ) and decreasing returns to scale for transplanted farms ( $b_i = 0.8734$ ) and direct seeded farms ( $b_i = 0.8374$ ) indicating that SRI was comparatively better system than transplantation and direct seeding methods. The production elasticities are negative for manures and fertilizers (-0.0036) in SRI, plant protection chemicals (-0.0060) in transplantation, and fertilizers (-0.0270) in direct seeded paddy farms indicating the excess usage of these inputs.

### Keywords

Cost and returns, paddy, SRI, transplantation

### JEL Codes

D01, Q10, Q12, Q16

### INTRODUCTION

Rice is one of the most ancient crops being cultivated in 117 countries, hence called as Global Grain. It is the most important staple food of the majority (60 per cent) of World's population, occupying first place among cultivated cereals and is being grown under different agro-climatic conditions (Devi & Ponnarasi, 2009). India has the largest area under rice crop and ranks second place in production next to China. Rice is grown in 534 districts in the country spread over 30 States and Union Territories. The area, production and productivity of rice in India is 44.8 million hectares, 99.37 million tones and 2.2 tons per hectare respectively. In Andhra Pradesh, rice is grown in 22 districts. Warangal district of Andhra Pradesh was purposively selected because out of 22 districts in A.P, 14 districts are falling under high productivity group, i.e. yield more than 2500 kg/ha. Warangal falls in this group with the average yield of 2619 kg/ha. Paddy is the chief food crop and important cereal crop in Warangal district

grown in about 1,85,111 ha of the total net sown area of 4,45,559 ha and with the production of 3,54,0000 tonnes. Among the various crops, rice is the maximum consumer of irrigation water. It takes 5000 liters of water to produce 1 kg of rice hence traditional rice production system is less efficient in the way it is used water. The increasing population in future demands more production of rice, which in turn needs more water. But, there is a decline in ground and surface water resources in the country and which may fall further in future years due to change in climate (global warming). At this juncture system of rice intensification (SRI) came into light. The System of Rice Intensification (SRI) is a method of paddy cultivation, though some consider and treat it as a technology. SRI method totally deviates from the traditional way of cultivating irrigated paddy over centuries and hence it has different water saving capabilities. The method uniqueness includes using less seeds, less water, less chemicals etc., (Ratnareddy *et al.*, 2005). Though the

knowledge on direct seeded rice from other areas is available, experience with this technique in Andhra Pradesh is limited (Reddy et al., 2008). So here in this paper we are comparing economics in these three methods of paddy cultivation that is, SRI, transplantation and direct seeding.

**MATERIALS AND METHODS**

The study was based on farm level data collected by survey method by using pretested schedules. Conventional and suitable production function analytical techniques will be employed to analyze the data and arrive at valid conclusions. Conventional tools include working out of simple averages, percentages, cost concepts, farm income measures. Cobb-Douglas production function will be fitted to assess the resource use efficiency of various inputs used in producing paddy under three methods of cultivation. Cobb-Douglas production function has been chosen for its flexibility and suitability. It is a power function and log-linear. The function is of the form,

$$Y = ax_1^{b_1} .x_2^{b_2} .x_3^{b_3} .x_4^{b_4} .x_5^{b_5} .x_6^{b_6} .x_7^{b_7} .\mu$$

Where,

Y = Gross income in rupees

x<sub>1</sub> = Land in hectares

x<sub>2</sub> = Seed expenses in rupees

x<sub>3</sub> = Total labour in rupees

x<sub>4</sub> = Irrigation charges in rupees

x<sub>5</sub> = Manures and fertilizers in rupees

x<sub>6</sub> = Plant protection chemicals in rupees

μ = Random term

**RESULTS AND DISCUSSION**

The results obtained from research findings regarding the cost of cultivation, gross returns, net returns, benefit cost ratio and production efficiencies are presented in the tables and graphs.

The perusal of Table 1 reveals that the total cost of cultivation was highest for SRI (₹68451.95/ha) followed by transplantation (₹51036.23/ha) and direct seeding methods (₹15722.26/ha) of sample paddy farms. This was mainly because of high human and machine labour costs. SRI cultivation requires skilled labour for operations like transplanting and weeding. This was followed by

**Table 2: Farm income measures of sample paddy farms (₹/ha)**

Particulars	Farm size group		
	Small	Medium	Pooled
<b>SRI cultivation</b>			
Gross Income	92250.01	93020.23	92506.75
Net Income	25100.19 (27.21)	24030.85 (25.83)	24054.72 (26.00)
Family labour Income	32354.27 (35.07)	31084.99 (33.42)	31247.88 (33.78)
Farm business Income	41742.71 (45.25)	40383.18 (43.41)	41289.53 (44.63)
Farm Investment Income	34488.65	<b>3329.04</b>	<b>34102.11</b>
<b>Transplantation</b>			
Gross Income	62900.04	65000.01	63950.00
Net Income	13237.49 (21.05)	11903.19 (18.31)	12913.77 (20.19)
Family labour Income	18163.74 (28.88)	16370.25 (25.18)	18298.29 (28.61)
Farm business Income	26256.22 (41.74)	24779.68 (38.12)	26517.55 (41.47)
Farm Investment Income	21329.97 (33.91)	20312.62 (31.25)	22071.70 (34.51)
<b>Direct seeding</b>			
Gross Income	20700.72	-	-
Net Income	4978.46 (24.05)	-	-
Family labour Income	6053.70 (69.24)	-	-
Farm business Income	9877.56 (47.72)	-	-
Farm Investment Income	8802.32 (45.52)	-	-

Figures in parentheses indicate percentage to gross income

machine power cost as the transplanting and weeding operations were carried out by employing equipment and

**Table 1: Economics of paddy cultivation in sample farms**

Particulars	(₹/ha)						
	SRI Cultivation			Transplantation			Direct seeding
	Small	Medium	Pooled	Small	Medium	Pooled	Small
Cost of cultivation	67149.81	71056.23	68451.95	49662.52	53096.81	51036.23	15722.26
Total gross returns	92250.00	93020.00	92506.67	62900	65000	63950	20700.72
Net returns	25100.19	24030.85	24054.72	13237.49	11903.19	12913.77	4978.46
Benefit-cost-ratio	0.37	0.34	0.36	0.27	0.17	0.24	0.32
Average yield (q/ha)	89.05	91.02	89.71	58.00	60.00	59.00	22.00
Average market price (₹/q)	1000.00	1000.00	1000.00	1050.00	1050.00	1050.00	800.23
Cost of production (₹/q)	754.07	780.67	762.93	856.25	1140.87	899.95	714.65

**Table 3: Production elasticities of sample paddy farms**

Particulars	SRI cultivation	Transplantation	Direct seeding
Number of farms	30	30	30
$b_i$	1.08	0.87	0.83
Adjusted R <sup>2</sup>	96.96	89.35	96.96
<b>Production elasticities</b>			
Land (X <sub>1</sub> )	0.0011***	-0.0005 <sup>NS</sup>	0.0001 <sup>NS</sup>
Seed (X <sub>2</sub> )	0.4121 <sup>NS</sup>	0.1775*	0.0015 <sup>NS</sup>
Total labour (X <sub>3</sub> )	0.6767*	0.5156**	0.3421***
Irrigation (X <sub>4</sub> )	-0.0076 <sup>NS</sup>	0.0773**	-
Manures and fertilizers (X <sub>5</sub> )	-0.0036 <sup>NS</sup>	0.1144 <sup>NS</sup>	-0.0270 <sup>NS</sup>
Pesticides (X <sub>6</sub> )	0.0037 <sup>NS</sup>	-0.0060 <sup>NS</sup>	0.5196 <sup>NS</sup>

\*\*\*, \*\*, and \* Significant at 1, 5 and 10 level.

NS: Non-significant

machinery like transplanting trays and rotary weeder. On an average, the net returns were ₹24054.72, ₹12913.77, and ₹4978.46 on pooled farms of SRI, transplantation and direct seeding methods of paddy respectively. The benefit cost ratio was found to be highest in sample SRI paddy farms (0.36) followed by direct seeded (0.32) and transplanted paddy farms (0.24).

The various farm efficiency measures like farm business income, family labour income and farm investment income worked out were found to be higher in SRI cultivated paddy farms as compared to transplantation and direct seeding methods. Per unit cost of production of paddy was ₹762.93, ₹899.95, and ₹714.65 per quintal on pooled farms of SRI, transplantation and direct seeding methods respectively (Table 2). The Cobb-Douglas production function analysis indicated increasing returns to scale in SRI ( $b_i = 1.0821$ ) and decreasing returns to scale for transplanted farms ( $b_i = 0.8734$ ) and direct seeded farms ( $b_i = 0.8374$ ) indicating that SRI was comparatively better system than transplantation and direct seeding methods.

The production elasticities are negative for manures and fertilizers (-0.0036) in SRI, plant protection chemicals (-0.0060) in transplantation, and fertilizers (-0.0270) in direct seeded paddy farms indicating the

excess usage of these inputs (Table 3).

### CONCLUSIONS

The study compares the costs and returns of paddy farms under SRI, transplantation and direct seeding methods. The Cobb-Douglas production function analysis indicated increasing returns to scale in SRI ( $b_i = 1.0821$ ) and decreasing returns to scale for transplanted farms ( $b_i = 0.8734$ ) and direct seeded farms ( $b_i = 0.8374$ ) indicating that SRI was comparatively better system than transplantation and direct seeding methods. From this we can conclude that SRI method performs better than other methods and helps to increase food production and incomes of the farmers.

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## Roadmap for Doubling the Millet Farmers' Income by 2021-22

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### ABSTRACT

*The call for doubling the farmers' income in India by 2021-22 has been a need of the hour. The agriculture in India comes largely under dryland conditions. Millets are mostly cultivated in dryland conditions in many parts of India where there is no scope for cultivating other cereal crops. Millets are resistant to adverse climatic conditions and can be grown with minimum access to irrigation water and various kinds of soil conditions. Thus with the increase in the earnings from millets cultivation will have a significant impact in the dryland farmers. The following strategy paper concentrates on the policy issues that are needed to be addressed shortly to improve the farmers' income in the coming years.*

### Keywords

Farmers' income, ICAR-IIMR, millets, noble grains

### JEL Codes

Q01, Q10, Q16, Q18

### INTRODUCTION

India is basically an agrarian society where sole dependence has been on agriculture since time immemorial. Agriculture is the principal means of livelihood of around 55.0 per cent of India's population and accounts for approximately one-fifth of the total gross domestic product (GDP). The initiative taken by the Honourable Prime Minister of India to double the farmers' income by 2021-22 is the call of the hour. The social and economic development of farm and farmers will eventually lead to the development of the nation. Alur & Maheswar (2016) have rightly pointed out that the increase in total farm output can be one of the strategies but not the only strategy for doubling the income. Millets are a traditional staple food for the rural poor in dry land regions of the country. Millets contribute substantially for food and nutritional security and are highly nutritious (also termed as *Nobel Grains*). In India, millets are grown on about 15 million ha with annual production of 17 million tons and contribute 10 per cent to the country's food grain basket. It forms the backbone of dryland agriculture in many parts of India; however, the direct consumption of sorghum and other millets as food has significantly declined over the past three decades. Increase in the production and consumption of millets in

India will have a direct impact on the farm income of Indian farmers since majority of the Indian agriculture is rainfed. Millets are the only viable option in the dryland condition since they require minimum application of irrigation and can withstand adverse weather conditions. Hence, there has been a focus is to generate demand of millets through value-addition of processed foods, feed and industrial products, processing of RTE and RTC foods from selected millet foods by various projects led by ICAR-Indian Institute of Millets Research (IIMR).

### Millets Scenario in India

India and the world have witnessed significant decrease in the area under the millets crops. In India total area under the millets crops declined with CAGR of 5.4 per cent annually from 2010-11 to 2014-15 and the production of total millets also declined @ 4 per cent annually. Since the annual decline in the production was less than that of area under crops, the productivity of the millets witnessed slight increase in the last five years with CAGR value of 1.2 per cent. The main reasons for decline of the millets crops in India as documented by National Academy of Agricultural Sciences (NAAS) in 2013 are low remuneration as compared to other competing crops, lack of input subsidies and price incentives, subsidized supply of fine cereals through PDS, and change in the

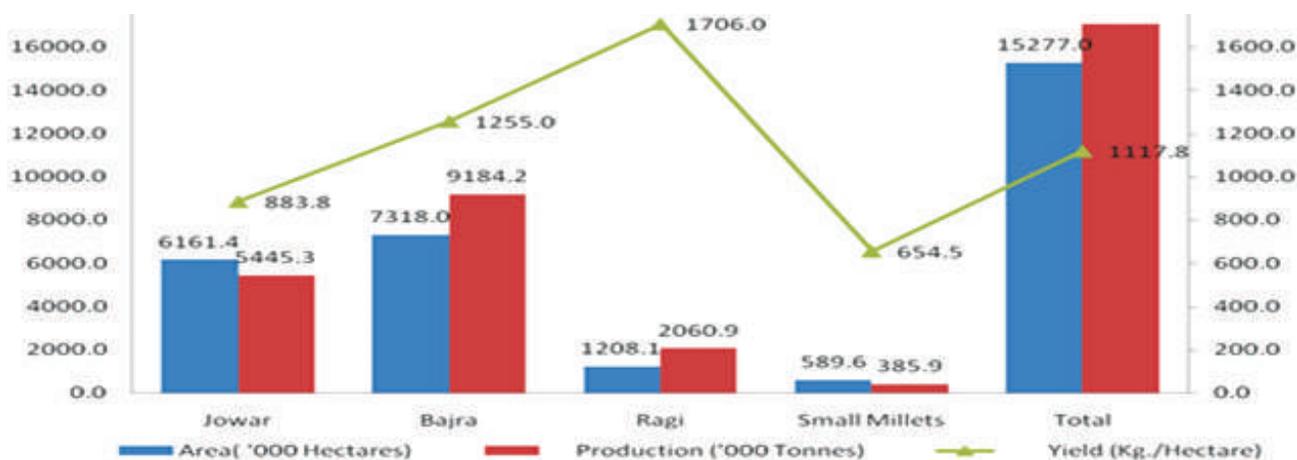


Figure 1: Area, production and yield of millets in India during 2014-15

Table 2: Trend of average cost of production, gross income and price of main product in major Millets producing states of India from 2009-10 to 2013-14

Years	Jowar			Bajra			Ragi		
	Cost A <sub>1</sub>	Gross income	Price of main product	Cost A <sub>1</sub>	Gross income	Price of main product	Cost A <sub>1</sub>	Gross income	Price of main product
2009-10	8209.09	14238.70	1083.28	8105.70	19134.87	900.66	17765.47	27758.46	1119.45
2010-11	10204.01	20521.16	1465.86	8663.06	19509.40	861.19	15950.54	27760.79	1159.23
2011-12	12827.30	25812.86	1587.56	11865.41	20814.20	941.45	15787.17	22661.22	1243.81
2012-13	14165.49	24201.50	1626.77	12844.51	27925.59	1236.46	17350.97	37138.20	1618.41
2013-14	16395.50	33037.21	1662.28	16659.61	34373.28	1304.25	18488.96	40606.30	1670.11

Source: Directorate of Economics and Statistics, Government of India, New Delhi.

consumer preferences. These factors had led to shift from production of millets (jowar in particular) to other competing crops such as soybean, maize, cotton, sugarcane and sunflower in the country as a whole. In the context of present Indian Agricultural scenario the production and income increase of the farmers through area expansion is of major limitation, since supply of area is inelastic in nature. To achieve the target of doubling the farmers' income by 2021-22 the policy makers also need to address issues other than area expansion.

It can be revealed from Table 2 that the average cost of cultivation (Cost A<sub>1</sub> or all paid out costs) and gross income per hectare from major millets in 2013-14 in the major millets growing states of India have doubled as compared to the year 2009-10. This two fold increase in the gross income was realised due to significant improvement in the yield and steady increase in the price of the main product realised by farmers in these states over the years.

The domestic consumption of millets in India has also varied significantly in the last decade as evident from the Table 3. The compound annual growth rate of domestic consumption of millets in India was only 1.1 per cent. This reveals that there prevails an inertia that prevents the

change in the consumption habit towards the millets. This could be due to various reasons like preference towards rice and wheat, lack of processing facilities for millets in the country, drudgery involved in cooking millets recipes, low social status attached with the millets consumption etc. The average annual growth of the millets consumption in India from 1999 to 2016 was 4.56 per cent. In order to address the issue of doubling the income of the farmers in India in the coming years, the consumption demand for the millets has to be enhanced through various demand creation measures.

It can be revealed that the millets have mostly been of subsistence nature in post-independence India as depicted by very low marketed surplus ratios (MSR) (Table 4). The MSR of sorghum has increased significantly over the years from a mere 24 in 1950-51 to 64.14 in 2012-13 which implies that sorghum farmers have started selling off their products after meeting the consumption needs. Similarly MSR of bajra (pearl millet) has also increased over the years. The marketed surplus ratio of ragi has become almost half as compared to the early 2000's. This can be understood from the above table and figure that millets in India are mostly grown to meet the home

Table 1: Area, production and yield of millet crops in India from 2010-11 to 2014-15

Year	Jowar			Bajra			Ragi			Small Millets			Total		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
2010-11	7381.7	7003.1	948.7	9612.3	10369.9	1078.8	1286.2	2193.5	1705.4	799.9	442.0	552.5	19080.2	20008.5	4285.4
2011-12	6245.1	5979.2	957.4	8776.7	10276.0	1170.8	1175.8	1929.2	1640.8	798.8	451.5	565.3	16996.3	18636.0	4334.3
2012-13	6214.4	5281.5	849.9	7297.4	8742.0	1198.0	1131.0	1574.4	1392.0	754.1	435.7	577.7	15396.9	16033.5	4017.6
2013-14	5793.4	5541.8	956.6	7810.7	9250.1	1184.3	1193.6	1982.9	1661.3	682.3	429.9	630.1	15480.1	17204.7	4432.2
2014-15	6161.4	5445.3	883.8	7318.0	9184.2	1255.0	1208.1	2060.9	1706.0	589.6	385.9	654.5	15277.0	17076.3	4499.2
CAGR	-4.4	-5.8***	-1.4	-6***	-3.5	3.10***	-1.10	-1.0	0.10	-7.7***	-3.2***	4.5***	-5.4***	-4.0	1.2

per cent

Source: Directorate of Economics and Statistics, Government of India, New Delhi.

\*\*\* Significant at 1 per cent level

Table 3: Domestic consumption of Millets in India from 1999 to 2016

Market year	(1000 MT)	
	Domestic consumption	Growth rate
1999	8780	-13.84 per cent
2000	10100	15.03 per cent
2001	11150	10.40 per cent
2002	6600	-40.81 per cent
2003	14200	115.15 per cent
2004	10840	-23.66 per cent
2005	10900	0.55 per cent
2006	10300	-5.50 per cent
2007	12500	21.36 per cent
2008	11500	-8.00 per cent
2009	8800	-23.48 per cent
2010	12500	42.05 per cent
2011	12900	3.20 per cent
2012	10900	-15.50 per cent
2013	11600	6.42 per cent
2014	11600	0.00 per cent
2015	10800	-6.90 per cent
2016	11400	5.56 per cent
CAGR per cent	1.1 <sup>NS</sup>	
Average		4.56 per cent

Source: United States Department of Agriculture, USA

Table 4: All-India marketed surplus ratio (MSR) of major millets, 1950-5 to 2012-13

Year	Jowar	Bajra	Ragi
1950-51	24	27	---
1999-00	47.6	61.7	26.5
2003-04	57	43.4	60.3
2004-05	69	56.1	79.5
2008-09	54.6	57.8	20.1
2009-10	65	70.3	37.2
2010-11	62	67.4	25.7
2011-12	53.5	67.5	53.5
2012-13	64.14	76.77	29.53

Source: Agricultural statistics at a glance 2014, Government of India New Delhi

consumption needs and are marketed only if left after meeting the daily needs.

### Strategies for increasing farmers' income through millets revival

The major millets growing regions in India are dominated by resource poor small and marginal farmers, who grow these crops to meet their home consumption demands. These farmers rarely go for marketing their produce since the output is of very small. In order to achieve the target of doubling the income of these farmers in the coming years it is very much essential to address both demand and supply side problems associated with millets cultivation. This emphasizes the need to address

the issues regarding the declining trend in the area and production of the sorghum and other millets. The decreasing trend of fall of area and production of the crop can both be addressed through the both demand creation and supply enhancement.

### Demand Creation for Millets Products

#### Value addition and farmers income

The development of alternative uses and new products from sorghum would be among the most effective mechanisms to maintain and improve the economic base of farmers in the semi-arid tropics of Asia. Cultivation of the millets in the traditional areas decreased significantly in the recent decades due to lack of processing facilities available at farm level and the associated drudgery in cooking millets. Proper value addition at farm level measures can be taken up to overcome these problems which will boost the millets cultivation nationwide and therefore will positively impact the farmers' income.

In this regard millets a value chain model is needed with emphasis on value addition and development of value added products from millets. Value chain model is essentially comprises of bringing all the stakeholders involved on a common platform, thereby, there is significant value creation at the end at each level. ICAR-IIMR has taken the leadership role in this direction by developing and commercialising a variety of value added millets products namely Jowar Atta, Jowar rich Multigrain Atta, Jowar Pasta, Instant Pongal Mix, Jowar Vermicelli and so on. IIMR has assessed the impact of value chain model in reviving the demands for millets in the long term. The positive impact of a value chain on millet foods will not only provide opportunities of higher income generation to the stake holders that is, farmers, primary processors and food processing entrepreneurs/companies but will also ensure nutritional security to the consumers

(Rao *et al.*, 2016). On-farm technological backstopping with end products specific cultivars/hybrids such as M 35-1, CSV 216R, Parbhani Moti, Phule Vasudha and Phule Revati in *rabi* season and CSH14, CSH16, CSH 23, CSV 20 and SPH 1148 during *kharif*, with extension services and buy-back assurance resulted in the increase of productivity of *kharif* sorghum by 48 per cent while *rabi* sorghum was increased by 37 per cent over the baseline (Figure 4). It also increased average income in *kharif* season by 541 per cent (₹35091/ha) and 436 per cent (₹66667/ha) in *rabi* season over baseline. The value of sorghum grain was increased from ₹800 to ₹1250 per tones at the end of the project (Figure 5).

The above model of income generation and yield enhancement of millets as adopted by ICAR-IIMR can be implemented throughout the country in millets growing regions to double the income of the farmers by 2021-22.

Besides the above mentioned points, various other measures to induce the demand for the millets could be enhanced are,

- Creation of awareness about the nutritional and health benefits of the millets products over other traditional foodgrains among the consumers could be a major step for demand creation. This could be done through proper and regular advertisement and awareness campaigning.
- The awareness programs should aim at eliminating the low social status attached to the consumption of the millets products for further enhancing the demand for these products.
- Introduction of the millets products in the public distribution system (PDS) and other food and nutrition related programmes like mid-day meal scheme will also create a substantial demand for these products.

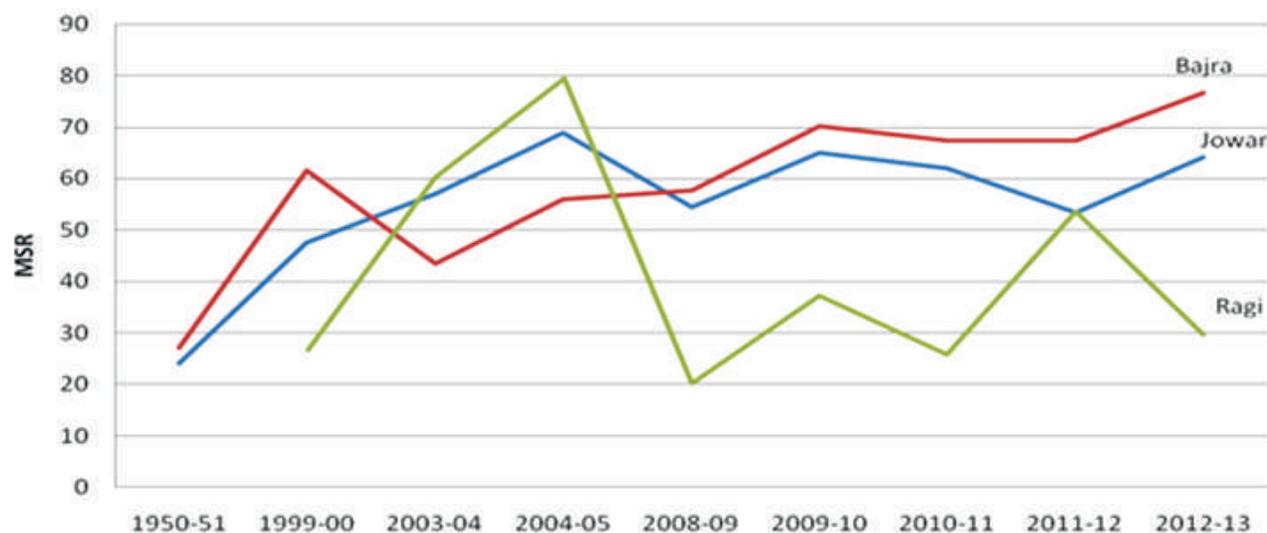


Figure 2: Marketed surplus ratio of millets in India

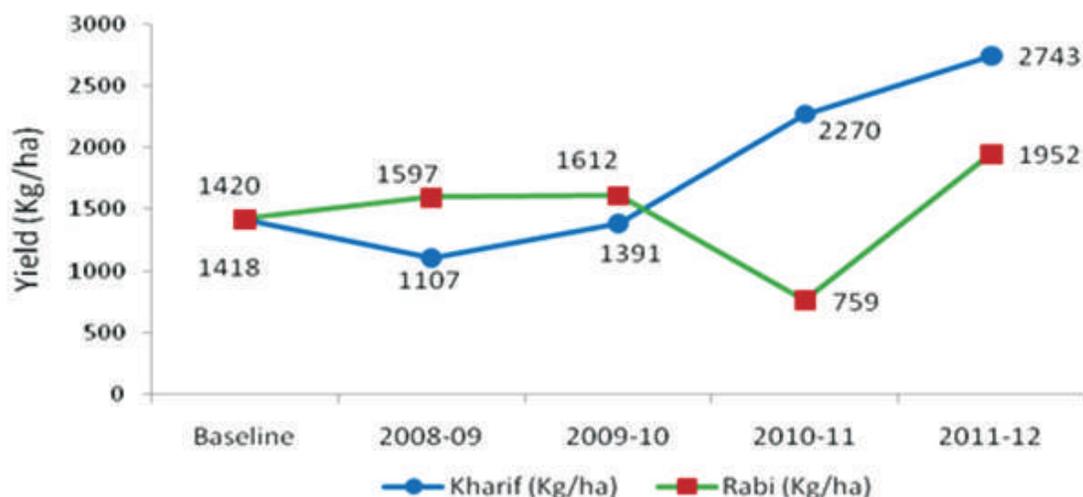


Figure 3: Yield of sorghum in farmer's field under NIAP project

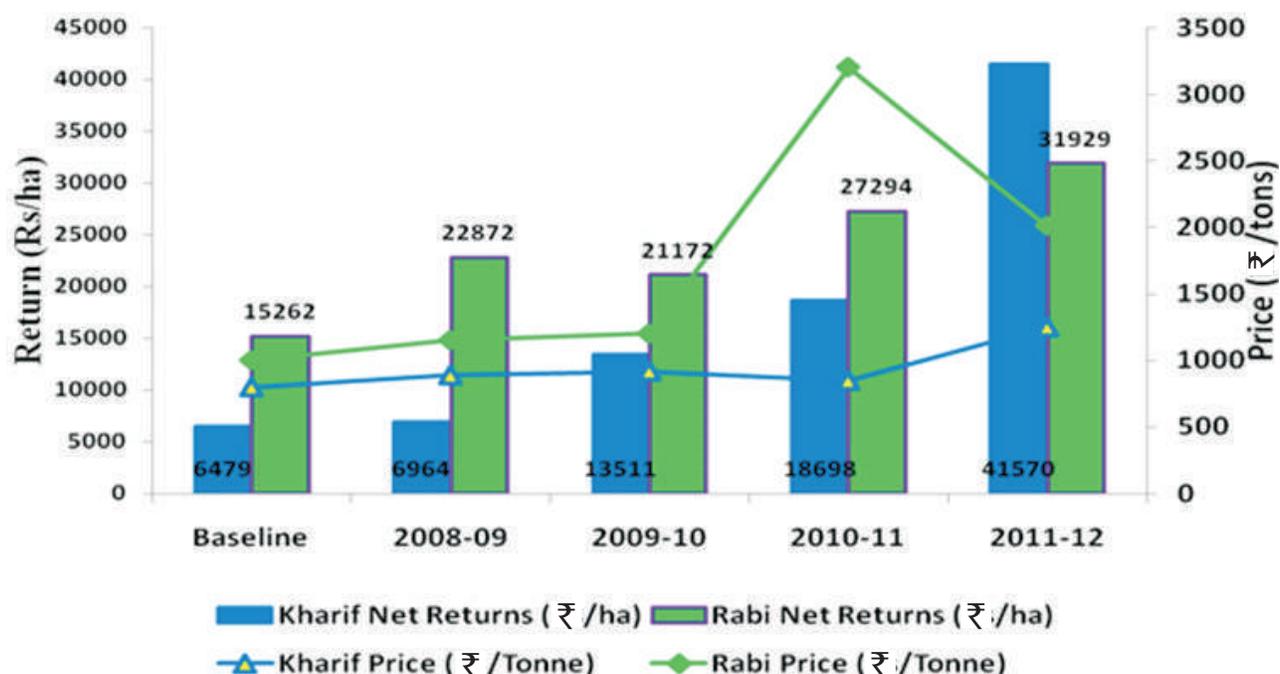


Figure : Net return and price of sorghum in farmer's field under NIAP project

### Supply side factors

Besides the above mentioned demand creating policies, the decreasing trend of area and production of the millets could also be addressed through supply enhancements. This can be done by

- Creation of awareness among the cultivators about the various positive aspects of the millets cultivation like the suitability in the dryland agriculture and more adaptability to the climate changes.
- Development and distribution of high yielding varieties (HYVs) and hybrids of millets among the

farmers.

- A proper systematic channel should be created for timely distribution of improved agronomic practices and other technical assistance. Any difficulties faced and reported by the farmers should be addressed with utmost priority.
- A remunerative price for the farm produce should be assured to the farmers through proper buy-back arrangements.
- Farmers should be covered under insurance schemes to avoid any loss due to crop failure and other natural calamities.

**Table 5: Minimum support prices (MSP) of millets (according to crop year) as on 01.06.2016**

Crop Name	Variety	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	Improvement over 2011-12 per cent
Jowar	Hybrid	980	1500	1500	1530	1570	1625	65.81
	Maldandi	1000	1520	1520	1550	1590	1650	65
Bajra		980	1175	1250	1250	1275	1330	35.71
Ragi		1050	1500	1500	1550	1650	1725	64.28

Source: Directorate of Economics and Statistics, Government of India, New Delhi

### Price and policy support

The government is providing price support to the millets growers in the form of minimum support prices. Major millets like jowar, bajra and ragi are covered under the Minimum Support Scheme (MSP) of Government of India. MSP fixed for 2016-17 for jowar, bajra and ragi witnessed an increase of 65, 35, and 64 per cent respectively over the year 2011-12. State Governments and their agencies should step up to extend the benefit of MSP to the farmers.

In a recent survey conducted by ICAR-IIMR in Mandla and Dindori districts of Madhya Pradesh has revealed that during the last two years cultivation of small millets namely Kodo millet and little millet has increased significantly due to good market prices and readily available markets to sell the produce. This signifies the fact that with availability of good market prices and readily available market for product, farmers are ready to take up more of this cultivation in commercial basis rather than subsistence one.

There is no provision of MSP for the minor millets including kodo and kutki from the government. This may hamper the cultivation of these crops which in turn will have a negative impact on the farmers. The government should step up with price support policies covering all the millets crops to enhance the farmers' income in the coming years.

### Inclusion of millets under Mid-day-Meal (MDM)

Ministry of HRD provides support for supply of 100 gm/child for primary (1-5<sup>th</sup> std.) and 150 gm/child food grain for post-primary (6-8<sup>th</sup> std.) in addition with ₹4.25 per child (veg./spice/cooking). Millets have been included under MDM by HRD Ministry. Millet based MDM was launched on pilot scale basis from 26<sup>th</sup> January, 2013 in Mahabubnagar (AP), Kolar (Karnataka) and Rural Pune (Maharashtra). Seven more districts in Karnataka was included during the year 2013-14. Millet based supplements were launched in Ariyalur and Perambalur districts of TN in 2013-14.

### Improvement of export competitiveness of Indian Millets

The international trade of millets has largely been dominated by the developed countries like USA as major exporting country. On the other hand the developing countries of Asia and Africa have been the major importing countries of sorghum in the international

market. The export potentials of these Asian countries are of limiting capacity. Enhancement of export competitiveness of Indian millets in the international markets will help the farmers to fetch good returns for their produces. Various measures that could be taken to improve the export competitiveness of the Indian as well as Asian millets are as follows:

- Most important factor that reduces the competitiveness of the Indian sorghum in the international market is the grain quality. Formation of fungal moulds in the millet crops poses a serious threat towards the improvement of the grain quality which significantly determines the competitiveness of the crops in the international market. Release of pest and disease resistant varieties could effectively solve this problem.
- Co-operative or collective cultivation of the sorghum will also help in the reducing the cost of cultivation and improve the bargaining power of the farmers, since it will help the farmers to jointly procure high-tech and costly farm machineries.
- Value addition to the sorghum and other millets products is the most effective way to improve the export competitiveness. Value added products produced by following the international food safety standards will increase the demand for the millets.
- Emerging business opportunities may be properly exploited for gaining exports by diversification of export basket- niche markets as gluten free, sweet sorghum syrup, alcoholic beer, stalks based ethanol/grain based potable spirit, value added nutriRTE/RTC foods etc.
- The farmers should be involved as stakeholders through an inclusive approach for a better share in consumer rupee through education on export markets.
- Infrastructure development particularly the road transport and store houses should be done on priority basis.

### Promotion of Farmers Producers Organization (FPO)

Creation and promotion of FPOs will be a step forward to building a sustainable and prosperous farming sector. These organizations will help the farmers to organize and enhance productivity through efficient, cost-effective and sustainable resource use and fetch higher returns.

Formation of FPOs will also help to increase the bargaining power of the farmer-producers through collective farming and marketing. These organizations will help in realizing the dream of doubling the farmers' income by 2021-22 in many ways. The farmers can get better prices for their produce when they sell in bulk. The problem of middlemen in the agricultural supply chain can also be eliminated and thereby increasing the producers' share in consumers rupee. Supply of location specific inputs, providing timely training programmes and direct procurement of the produce can be effectively managed through these organisations.

#### **Integrated Farming Systems Approach**

Farming systems in India is preoccupied with monoculture i. e., one crop at a time. This leads to large crop failures in the dryland conditions where there is no provision for irrigations. In these conditions promotion of integrated farming systems approach and intercropping with millets will lead to increase in the farmers, income. In the integrated farming systems approach, introduction of animal husbandry along with agricultural crops and forestry will help to supplement the farmers' income and help in doubling the farmers income by 2021-22.

#### **CONCLUSIONS**

The goal of doubling the farmers' income by 2021-22

of the government of India will only be fulfilled only when all the aspects of farming are taken care of starting from the seed to the marketing of the produce. The farming systems in India and the income generated from it has to be sustainable. In the context of present Indian and global farming situations where agriculture is getting affected increasingly due to adverse weather conditions, due attention is has to be paid towards dryland and low input intensive farming practices. Millets are the most viable solutions in this direction, since these crops are highly resistant to the changing weather conditions and require very less inputs. Introduction of millets in the farming practices in the dry parts of the country will immensely help in increasing the farmers' income in the coming years. The goal of doubling the farmers' income within six years, i. e., by 2021-22 may come true when the above mentioned issues are taken care of.

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## Protected Cultivation of Capsicum in Haryana

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### ABSTRACT

The study revealed that producers obtained maximum share in consumer rupee from direct marketing of capsicum i.e. more than 90 per cent which may be due to non-existence of market intermediaries between producers and consumers. Whereas least share in consumers rupee were observed in Channel-IV(Distant market) i.e. less than 50 percent which may be due to large number of middlemen involved in marketing chain of capsicum. As far as marketing efficiency was concerned, Channel – I (Producer – Consumer) was found most efficient among all other prevailing marketing channels in the study area. Lack of poly house/ crop insurance schemes to mitigate the risk arising due to damage of structure/ crop (84.00 per cent), followed by attack of insect-pest as well as nematodes (80.00 per cent), supply of inferior poly-house materials/lack of advice from service providers (80.00 per cent) were found most prominent constraints in the production of capsicum under poly house, whereas, lack of market information about prices and demand in different markets (80.67 per cent), non-remunerative prices of produce (76.00 per cent) were observed some of the marketing constraints. Keeping in view all the aspects, there is need to provide more support to realize full potential by development of efficient market infrastructure, providing liberal financial support at lower interest rate. Poly house enterprises should be treated as agricultural rather than commercial entity.

### Keywords

Marketing efficiency, national capital region, protected cultivation, peri-urban agriculture, proximity

### JEL Codes

C81, M31, Q13, Q18

### INTRODUCTION

Capsicum (Sweet Pepper or Bell Pepper), also popularly called as Simla Mirch in India is one of the leading vegetables grown in open conditions as well as under protected conditions. Because of its economic importance as a high value vegetable crop both in domestic and overseas markets due to more consumer preferences and use in various culinary products, quality production of capsicum is the need of the day. This has led to production of capsicum under protected conditions to meet the standards of different markets prompting popularity of this crop as an enterprise in urban and peri-urban areas (IIHR 2011).

Protected cultivation offers several advantages to produce vegetables, flowers and planting material of high quality and yields, thus using the land and other resources more efficiently. This becomes more relevant to small and marginal growers who have small land holding and would be interested in a technology, which helps them to

produce more crops each year from their land, particularly during off-season when prices are higher (IARI 2014). Haryana is well suited for the promotion of horticulture, especially in view of its vicinity to the National Capital Region and other big cities around, besides having easy access to both domestic and external markets. In this context, technology of Protected Cultivation, to grow low volume high value crops, offers great potential to the farmers engaged in peri-urban agriculture. The technology is also scale neutral as it benefits both the large-scale and small scale farmers and ensures higher productivity as well as income (Report of HKA, 2013). Protected cultivation in Haryana is still in a state of infancy, as at present, around 194 ha of area are covered under different protected structures in various regions for producing mainly vegetables and a few floricultural crops. The area under protected cultivation in Haryana is likely to increase fast in near future in the wake of several initiatives under schemes from Central and State

Governments. Capsicum was found most profitable vegetable crop under poly house cultivation among all other vegetables crops like capsicum and tomato in Haryana. Climate change being erratic and unpredictable with available technologies in the state makes it necessary to switch on to a cultivation system which provides protection to the crops against biotic and abiotic stresses envisaged with such changes. The scope of area expansion under cultivation of vegetables and flowers is very little, the only option is vertical expansion through increased productivity and cropping intensity using protected farming with environment control measures, quality seeds, fertilizers and plant protection measures, plastic mulching, protected nursery production, use of green/ polyhouses for off-season production of vegetables and flowers have consistently given good results both at research farms and farmers' fields. Keeping in view all the issues the present study has undertaken in Haryana state in year 2013-14.

**MATERIALS AND METHODS**

The study was conducted in Karnal district of Haryana having the highest number of poly houses in the state. From the district, Gharounda block having more than 50 per cent of the total poly houses of the district, was selected purposively. Fifteen poly houses farmers were selected and interviewed for collection of primary data related to various production and marketing aspects of capsicum. Two markets namely Karnal and Panipat within study area and another distant markets, Azadpur (Vegetables) was selected and five traders each (Wholesaler-cum-Commission agents and retailers) were selected randomly from each selected market to collect primary data on various marketing aspects. The required secondary data were also collected from State Agriculture Department as well as from Horticulture Department and other related agencies. Simple tabular analysis and Acharya's technique to work out marketing efficiency was applied to analyse the data and to draw the inferences.

**RESULTS AND DISCUSSION**

**Socio-economic Profile of Selected Polyhouse Owners**

Average family size was 6.67 persons comprising of 66 per cent adults and 34 per cent children. Majority of the adopters were between the ages of 40 to 50 years. About 66 per cent had farming as the main occupation living in joint families. There was high literacy status of polyhouse owners and almost all the selected farmers had acquired education above matriculation. The government incentives/ subsidy (40.00 per cent), farmers interest (26.67 per cent), expected high profitability (20.00 per cent) has proved to be the major factors for adoption of protected cultivation. (Table 1).

**Marketing Channels**

Five marketing channels have been identified that were prevalent in the study area. These channels were adopted by the farmers to dispose off or to market their capsicum produce as follows:

Channel-I: Producer Consumer

**Table 1: Socio-economic profile of selected polyhouse owners in Karnal district of Haryana**

Particulars	Overall average	Per cent
<b>Average size of family (No.)</b>		
Adults	4.40	65.96
Children	2.27	34.04
Total	6.67	100.00
<b>Age of respondents (Year)</b>		
Below 40	3	20.00
Between 40 to 50	7	46.67
Above 50	5	33.33
<b>Occupation</b>		
Farming household	10.00	66.66
Other	5.00	33.33
<b>Family type</b>		
Joint	9.00	60.00
Nuclear	6.00	40.00
<b>Literacy status</b>		
Below Matriculation	1.00	6.67
Up to Sr. secondary	6.00	40.00
Graduate	6.00	40.00
Post Graduate	2.00	13.33
<b>Motivating factor</b>		
Subsidy	6	40.00
Farmer's Interest	4	26.67
Profit earning enterprise	3	20.00
Following the fellow	2	13.33

Channel-II: Producer Wholesaler-cum-Commission Agent (CA) Retailer Consumer  
 Channel-III: Producer Retailer Consumer  
 Channel-IV: Producer Middleman (Broker) Retailer Consumer  
 Channel-V: Producer Apni Mandi Consumer

**Marketing Cost and Price Spread in Capsicum (Coloured)**

Marketing cost plays a crucial role in determining marketing efficiency of agricultural commodities. Analysis of price spread is significant from both producers as well as consumers point of view. An ideal price spread is one where producer gets his due share and at the same time, consumer gets best quality at affordable price. The break-up of price paid by the consumer into different market functionaries and net price received by the producer in sale of capsicum (Coloured) through different channels has been depicted in Table 2. The maximum share of producer in consumer's rupee was in Channel-I i.e. 92.88 per cent and followed by Channel-V, Apnimandi which was accounted 92.59 per cent. Share of producer in consumer's rupee was lowest (44.28 per cent) in the sale of capsicum through Channel-IV (distant markets) involving broker in the supply chain. Marketing cost born by the producer was highest in channel-

IV(16.11per cent) and lowest in Channel- III (5.90per cent). Whereas the margin of intermediaries was highest in Channel-II where the retailer got ₹6000/q (28.87 per cent) out of price paid by the consumer. In absolute terms, the producer received the highest net sale price in Channel-V (₹5000/q) followed by Channel-I (₹4365/q).

**Table 2: Price spread of capsicum (coloured) grown under poly house**

	(₹/q)				
Particulars	Channel-I	Channel-II	Channel-III	Channel-IV	Channel-V
<b>At producer's level</b>					
Net price received by producer	4365 (92.88)	3259 (54.31)	3685 (60.90)	3985 (44.28)	5000 (92.59)
Marketing cost borne by the producer	335 (7.12)	361 (6.02)	356 (5.90)	1450 (16.11)	400 (7.41)
Sale price of producer in market	-	3620 (60.33)	4041 (66.80)	5435 (60.39)	-
<b>At Commission Agent cum wholesaler's level</b>					
Marketing cost borne by trader	-	75 (1.25)	-	180 (2.00)	-
Margin	-	189 (3.15)	-	1380 (15.33)	-
Sale price in the market or purchase price of retailer	-	3384 (64.73)	-	6995 (77.72)	-
<b>At retailer's level</b>					
Marketing cost borne by retailers	-	384 (6.40)	370 (6.11)	425 (4.72)	-
Margin	-	1732 (28.87)	1639 (27.09)	1580 (17.55)	-
Sale price of retailer or price paid by consumer	4700 (100.00)	6000 (100.00)	6050 (100.00)	9000 (100.00)	5400 (100.00)

Figures in parenthesis represents percentage of consumers price

**Table 3: Price spread of capsicum (green) grown under poly house**

	(₹/q)				
Particulars	Channel-I	Channel-II	Channel-III	Channel-IV	Channel-V
<b>At producer's level</b>					
Net price received by producer	2656 (92.71)	2322 (53.90)	2300 (61.34)	2750 (49.77)	2950 (92.48)
Marketing cost borne by the producer	209 (7.29)	189 (6.42)	175 (6.15)	715 (12.94)	240 (7.52)
Sale price of producer in market	-	2511 (60.32)	2475 (67.49)	3465 (62.71)	-
<b>At Commission Agent cum wholesaler's level</b>					
Marketing cost borne by trader	-	62 (1.26)	-	90 (1.63)	-
Margin	-	112 (3.15)	-	570 (10.32)	-
Sale price in the market or purchase price of retailer	-	2685 (64.73)	-	4125 (74.66)	-
<b>At retailer's level</b>					
Marketing cost borne by retailers	-	243 (6.81)	250 (6.51)	400 (7.24)	-
Margin	-	850 (28.46)	1075 (26.00)	1000 (18.10)	-
Sale price of retailer or price paid by consumer	2865 (100.00)	3778 (100.00)	3800 (100.00)	5525 (100.00)	3190 (100.00)

Figures in parenthesis represents percentage of consumers price

**Table 5: Problems/constraints faced by tomato growers in protected cultivation**

(N=15)

Particulars	Overall (Per cent)
<b>Production problems</b>	
Lack of polyhouse/crop insurance scheme	84.00
<b>Problems of Nematodes</b>	80.00
Supply of inferior polyhouse materials/Lack of advice from service providers	80.00
<b>High cost of improved quality seed/seedling material</b>	66.66
Scarcity of skilled labour	53.33
Inadequate power supply and higher charges	53.33
Lack of proper guidance from extension agencies	50.67
Lack of adequate and timely supply of inputs	38.00
Non availability required credit for operational expenses	34.00
<b>Marketing problems</b>	
Lack of market information on price and demand in different markets	80.67
Non-remunerative prices of produce	76.00
Time consuming marketing process in distant markets	64.00
Lack of market competition among market functionaries	50.67
High cost of marketing due to perishable nature of products	48.67
Malpractices adopted by market intermediaries	47.34
Delay in payment by traders	46.00
High transportation cost and limited availability of cold chain	44.67
Lack of knowledge about proper packaging and grading techniques	42.67

**Table 4: Marketing efficiency of Capsicum sold through different channels**

Particulars	Capsicum	Capsicum
Channel-I	14.03	13.71
Channel-II	7.32	7.65
Channel-III	8.33	8.94
Channel-IV	4.38	4.59
Channel-V	13.50	13.29

Similar results were observed by Ghanghas *et al.* (2015) in their study.

#### Marketing Cost and Price Spread in Capsicum (Green)

In marketing channel of capsicum (green), the per cent share of producer in consumer's rupee was almost same in both direct channels i.e. Channel-I (92.71 per cent) and Channel-V (92.48 per cent). However, the share of producer in consumer's rupee was lowest (49.77 per cent) in the sale through Channel-IV (distant markets) involving broker in the supply chain. The share of marketing cost borne by producer was also fairly high in Channel-IV (12.94 per cent) and was found lowest in Channel-III (6.15 per cent). Producer received the highest net price in sale through Channel- V (₹2950/q) followed by Channel IV (₹2750/q). The highest price paid by the consumer was in Channel-IV (₹5525/q) followed by Channel-III (₹3800/q). Similar results were observed by CSK HP KVP Report (2013) (Table 3).

#### Marketing Efficiency of Capsicum among Different

#### Marketing Channels

In case of capsicum coloured and green, the marketing efficiency was observed higher in the sale through Channel-I (14.03 & 13.71) followed by Channel-V (13.50 & 13.29) respectively, which may be due to non-existence of middlemen in the between producer and consumer. Whereas least marketing efficiency was found in Channel-IV (4.38 & 4.59) respectively, which may be due higher transportation cost, brokerage and involved of large number of market middlemen in marketing chain (Table 4).

#### Problems and Constraints

The sampled capsicum growers under poly house cultivation faced various problems in production as well as marketing of their produce. Most of respondent farmers expressed lack of polyhouse/ crop insurance schemes to mitigate the risk arising due to damage of structure/crop (84.00 per cent), followed by attack of insect - pest as well as nematodes (80.00 per cent), supply of inferior polyhouse materials/lack of advice from service providers (80.00 per cent), high cost of improved quality seed/seedling material (66.66 per cent), Inadequate power supply and higher charges and scarcity of skilled labor (53.33 per cent), lack of proper guidance from extension agencies (50.67 per cent) as the major production problems. Beside theses lack of market information about prices and demand in different markets (80.67 per cent), non-remunerative prices of produce (76.00 per cent), time consuming marketing process in distant markets (64.00 per cent), lack of market competition among market functionaries (50.67 per cent)

high cost of marketing due to perishable nature of products (48.67 per cent) were observed as marketing constraints. The vegetable growers also reported malpractices adopted by market intermediaries (47.34 per cent) and Lack of proper knowledge about standards for grading (42.67 per cent) in the study area. Similar results were observed by Ghanghas *et al.* (2015) (Table 5).

### **CONCLUSIONS**

The study was conducted in Karnal district of Haryana having the highest number of poly houses in the state. Required primary as well secondary data were collected from related stakeholders. The study concluded that producers obtained maximum share in consumer rupee both in coloured as well as green capsicum from direct marketing weather its direct sale to consumer at their own farm gate or sale through Apni mandi of their produce (more than 90 per cent) which may be due to non-existence of market intermediaries between producers and consumers. Whereas least share in consumers rupee were observed in Channel-IV i.e. less than 50 per cent (Distant market) which may due to large number of middlemen involved in marketing chain of capsicum. As far as marketing efficiency was concerns, Channel-I was found most efficient among all other marketing channels. Capsicum growers also faced various problems related to production. Most of respondent farmers expressed lack of polyhouse/ crop insurance schemes to mitigate the risk arising due to damage of structure /crop (84.00 per cent), followed by attack of insect - pest as well as nematodes (80.00 per cent), supply of inferior poly-house

materials/lack of advice from service providers (80.00 per cent). Whereas, lack of market information on price and demand in different markets (80.67 per cent), non-remunerative prices of produce (76.00 per cent) were found most prominent constraints in marketing of produce. Keeping in view all the constraints and opportunities in capsicum cultivation under poly houses and close proximity of national capital region of the state , There is need to provide more support to realize full potential by development of efficient market infrastructure, providing liberal financial support at low interest rate. Poly house enterprises should be treated as agricultural rather than commercial entity so that emerging poly house enterprise proved to be more profitable for the farmers of the state.

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## **Income and Employment from Winter Vegetables vis-à-vis Competing Crop Wheat in Punjab**

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### **ABSTRACT**

*The study revealed that one hectare of land put under Cauliflower crop provided employment to the extent of (657 hours) per hectare as compare to pea (538 hours) per hectare and wheat (288 hours) per hectare. Cauliflower crop was the most employment generating crop in the sample district. The analysis reveals an average farm family spends ₹81651 per hectare as total variable cost as compared to cauliflower (₹45603) per hectare and wheat (₹25934) per hectare. The comparative analysis of the return from vegetable and wheat crop reveals that pea yielded the maximum returns to the farmer followed by cauliflower and wheat. Wheat is least paying crop to the farmer whereas pea is paying maximum and cauliflower is second more in order. The regression analysis reveals that area, family labour and plant protection were found to the positively significant for pea. In case of cauliflower crop area, age of the respondent and family labour was positively significant and in case of wheat crop agronomic practices, irrigation, and manure and fertilizer were positively significant.*

### **Keywords**

Income, wheat, winter vegetables

### **JEL Codes**

C81, Q00, Q10, Q18

### **INTRODUCTION**

With concerted effort by the policy makers of considering ways of doubling farm income along with employment opportunities, various options need to be study. Vegetable cultivation is one such options as it is labour intensive and offer a considerable promise for generating increased rural employment opportunities (Akter *et al.*, 2011). Due to the problems created by paddy- wheat rotation, it is being realized that we cannot go a long way with the rotation. Vegetable cultivation is also a good replacement of paddy- wheat rotation and also give high returns per unit of area as compared to rice and wheat (Sharma *et al.*, 2000) and hence provide opportunity for diversification. This cultivation can make the use of land more intensively as the vegetables are short duration crops and provide regular income to meet day to day requirement of the family (Samra and Kataria, 2014).

Punjab is a leading state in terms of production of vegetables. The annual productivity of the state is 16.8 Mt/ha as compared to the average national productivity of 14 Mt/ha. The area under vegetables in Punjab state was

2.45 per cent and in Amritsar district was 3.75 per cent in 2015-16.

However, considering vegetable farming as one of the options of increasing farm income in general and on small and marginal farmers in particular, the study is being undertaken to assess the remunerative worth of the winter vegetable farming vis-a-vis competing crop wheat with the following specific objective;

- i to examine the pattern and magnitude of employment generated by winter vegetables vis-à-vis competing crop wheat,
- ii to estimate the level of income generated on vegetables farm vs wheat crops for different farm size holding and
- iii to study the factor effecting productivity of winter vegetables and wheat.

### **METHODOLOGY**

The present study was conducted during 2015-16. Multistage stratified sampling technique was used to select block, villages and households from selected district Amritsar. Two blocks (Jandiala and Majitha) with

higher area under vegetables were purposively selected.

One village from each block was purposively selected having higher acreage under vegetable cultivation. The villages are:

Block	Villages
Jandiala	Malakpur
Majitha	Ajeabali

Equal number of respondents (cultivating vegetable and wheat crops) were selected from each village. The entire cultivator households were enlisted arranged in ascending order in terms of operational area and cumulative frequency were obtained. The farmer was classified into three sizes of classes of small, medium and large farmer. The small farm size obtained was up to 2 hectares, medium size between 2-5 hectares and large size was above 5 hectares. The household sample included 60 purposively selected households per village making a total sample of 120.

#### METHOD OF ANALYSIS

Pattern of employment and its magnitude, Cost structure and Returns from vegetables vis a vis wheat crop were achieved by using simple averages and percentages.

Factors affecting production and productivity of different vegetables was worked out through the use of functional analysis regressing the dependent variable (i.e gross value product with respect of each vegetable separately) against various explanatory variables. Both linear as well as log linear equations were tried to obtain the best results. Several equations were fitted by taking the different variables at a time and dropping another one already taken in earlier equations. The functional form used in case of linear and log linear functions taken up is given below.

$$Y = b + b_1x_1 + b_2x_2 + \dots + b_nx_n$$

$$Y = a_0x^{b_1} + b_0x^{b_2} + \dots x^{b_n} eu$$

Where Y is the dependent variable (gross value product).

$a_0$  and  $b_0$  are the intercept terms in the above equations respectively.

$b_1$  through  $b_n$  are regression coefficient for various explanatory variables.

eu is the random error.

The detail of the variables along with their units used in the analysis is as under:

$X_1$  = Area under each vegetable crop separately (hectares)

$X_2$  = Expenditure incurred on seeds plus the value of owned seeds at the farm gate prices (₹)

$X_3$  = Age of the respondent (years)

$X_4$  = Agronomic practices (₹) (Which includes the rent paid of ploughing, planking etc.) (₹)

$X_5$  = Irrigation charges (₹) (Fuel charges)

$X_6$  = Family labour (Hours.)

$X_7$  = Hired labour (Hours.)

$X_8$  = Cost of manure and fertilizers (₹)

$X_9$  = Cost of plant protection measures (₹)

$X_{10}$  = Gross value product (₹)

The best choice of the function and equation for each of the vegetable was made on the basis of the value of  $R^2$ , significance and signs of the coefficient.

#### RESULTS AND DISCUSSION

##### Labour Use Pattern

The perusal of the Table 1 compares the total labour requirement for pea, cauliflower and wheat crop. Total labour used were maximum in the case of cauliflower (657 hours) followed by pea (538 hours) and wheat (287 hours) on per hectare basis. Total hired labour used were the highest in case of cauliflower (50.43 per cent) followed by pea (46.65 per cent) and wheat (35.94 per cent) and family labour used were maximum in wheat (64.12 per cent) followed by pea (53.75 per cent) and cauliflower (49.59 per cent).

Operation wise analysis of the table shows that the maximum hours of labour were used in case of the pea crop for picking (101 hours) followed by sowing (83 hours) and manure and fertilizer (76 hours). In case of cauliflower crop maximum labour hours were used in case of picking (116 hours) followed by weeding (129 hours) and sowing (107 hours). In case of the wheat crop maximum labour hours were used in case of manure and fertilizer (54 hours) followed by irrigation (51 hours). In case of family labour, the male labour used in cauliflower (40.92 per cent), pea (43.8 per cent) and wheat (50.81 per cent) and female labour hours were higher in case of wheat (13.31 per cent). In case of hired labour the male labour used was higher in case of cauliflower (39.9%) followed by pea (34.57 per cent) and wheat (35.94 per cent) and female labour hours were used in case of cauliflower (10.53 per cent) and in case of pea (11.89 per cent).

##### Cost Structure

The information pertaining to cost composition and total expenditure per hectare with respect to vegetable and wheat crop have been shown in Table 2. This would enable us to know which of the vegetable and wheat crop need more investment on the one hand and which variable is most significance for each vegetable and wheat crop on the other hand respectively. Observations emerge that pea crop is the most expensive as the highest expenditure of ₹81652 per hectare was incurred on it whereas expenditure incurred on wheat was minimum (₹25934 per hectare).

As far as important components of production variable cost are concerned, seed was found to be the most important for pea (50.75 per cent) of total variable cost, human labour for cauliflower (28.13 per cent) and manure and fertilizer for wheat crop (28.69 per cent) of total variable cost which is accounted for maximum. Amongst the component of marketing cost, packaging expenditure was found to be the most important for pea while transportation charges for wheat.

Overall results indicated that seed in case of pea and

**Table 1: Comparative analysis of operation wise use of labour for pea, cauliflower and wheat cultivation at the overall level**

Particulars	Family Labour			Hired labour			(Hr per ha)
	Male	Female	Total	Male	Female	Total	Total labour
<b>Pea</b>							
Pre-sowing	33	6	39	32	-	32	71
Sowing	30	7	38	45	-	45	83
Weeding	14	6	20	13	-	13	33
Manure and fertilizer	37	8	45	30	-	30	76
Plant protection	32	6	38	28	-	28	65
Irrigation	40	7	47	16	-	16	63
Picking and packaging	24	9	33	4	44	68	101
Transportation	27	4	31	19	-	19	48
Total	236	53	289	186	44	251	538
	(43.80)	(10.04)	(53.75)	(34.57)	(11.89)	(46.65)	(100.00)
<b>Cauliflower</b>							
Pre-sowing	35	6	41	23	-	23	61
Sowing	19	7	26	69	-	69	95
Weeding	25	8	33	66	-	66	99
Manure and fertilizer	45	8	53	34	-	34	87
Plant protection	41	7	48	31	-	31	78
Irrigation	55	8	63	27	-	27	90
Picking and packaging	33	8	41	6	69	75	116
Transportation	18	5	23	8	-	8	32
Total	269	57	326	262	69	331	657
	(40.92)	(8.67)	(49.59)	(39.90)	(10.53)	(50.43)	(100.00)
<b>Wheat</b>							
Pre-sowing	22	4	26	20	-	20	46
Sowing	21	4	26	16	-	16	41
Weeding	22	5	27	14	-	13	40
Manure and fertilizer	27	7	34	20	-	20	54
Plant protection	11	5	16	6	-	6	23
Irrigation	28	6	34	17	-	17	51
Picking and packaging	5	4	8	5	-	5	13
Transportation	10	3	13	7	-	7	20
Total	146	38	185	104	-	103	287

Figures in the parentheses indicate the percentage to the total

human labour in case of cauliflower and manure and fertilizer in case of wheat were the most important variable involving highest expenditure of all costs.

### Comparative Analysis of Returns

Table 3 depicts the overall results which indicate that returns over production variable cost were found to be highest from pea with ₹71308, followed by cauliflower (₹57497) and wheat (₹37797) per hectare.

The picture regarding returns over total variable cost highlighted that the maximum returns were obtained from pea crop with ₹68352 per hectare. This was followed by cauliflower (₹55460) and wheat (₹36564). Thus, the overall scenario showed that pea was the most paying vegetable whereas wheat ranked at the bottom in the study area.

### Regression Analysis

This section mainly concerns with the examination of

the factors affecting productivity of different vegetables and wheat crop in the study area. Gross value product per farm has been taken as dependent variable whereas the area, seed, age, agronomic practices, hired labour, family labour, irrigation, manure and fertilizer and plant protection taken as the explanatory variable. Linear production function is fitted to the data collected for each of the principle vegetables and wheat crop separately. Various equation by dropping one another some of the variable on the one hand and adding the other, were tried. The choice of the best equation for each of the vegetable was made on the basis of the value of  $R^2$  explained and relevance of the expected sign of coefficient.

Multiple regression analysis was carried out by using SPSS-16 to identify the factors affecting gross value products of Pea, Cauliflower and Wheat. The detailed

**Table 2: Comparative cost structure analysis for pea, cauliflower and wheat**

Components of variables cost	₹/ha		
	Pea	Cauliflower	Wheat
<b>(A) Components of production variable cost( overall for all size categories)</b>			
Seed	41441 (50.75)	10684 (23.43)	2640 (10.18)
Manure and fertilizer	8981 (11.00)	7421 (16.28)	7440 (28.69)
Plant protection	1982 (2.43)	2025 (4.44)	1130 (4.36)
Irrigation charges	865 (1.06)	2287 (5.02)	1577 (6.08)
Agronomic Practices	6033 (7.39)	6762 (14.83)	6479 (24.98)
Labour charges	16584 (20.31)	12830 (28.13)	4552 (17.56)
Interest on working capital	2807 (3.41)	1554 (3.41)	881 (3.40)
Subtotal (A)	78697 (96.38)	43566 (95.53)	24701 (95.25)
<b>(B) Marketing cost</b>			
Packing expenses	1635 (2.00)	767 (1.68)	257 (0.99)
Transportation and marketing expenses	1319 (1.62)	1269 (2.78)	976 (3.76)
Subtotal (B)	2955 (3.62)	2037 (4.47)	1232 (4.75)
Total variable cost	81652 (100.00)	45603 (100.00)	25934 (100.00)

Figures in the parentheses indicate the percentage to the total

**Table 3: Comparative analysis of returns from production of pea, cauliflower and wheat**

Variables	₹/ha		
	Overall for all size categories		
	Pea	Cauliflower	Wheat
Gross returns	150004	101073	62498
Production variable cost	78696	43576	24701
Return over production variable cost	71308	57497	37797
Marketing cost	2955.1	2037.4	1232.5
Return over total variable cost	68352	55460	36564

results pertaining to coefficient of various variables tried in the equation are incorporated in above table.

The regression analysis was also carried out to examine the effect of different variables affecting the gross value product. In case of pea crop, the results revealed that area, family labour, and plant protection were found to be positively significant indicating that the

use of these inputs should be intensified if the pea grower want to improve their returns from this crop and irrigation were found to be negatively significant. Rest of the variable turned out to be non-significant.

As far as the regression analysis in case of cauliflower crop was concerned, area, age of the respondent and family labour were found to be positively significant indicating that the use of these inputs should be intensified if the cauliflower grower want to improve their returns from this crop and manure and fertilizer were found to be negatively significant. Rest of the variable turned out to be non-significant.

In case of wheat crop, it has been observed that a unit change in area could increase the gross value product by ₹2166.63 and one unit increase in agronomic practices, irrigation and manure and fertilizer were found to be positively significant indicating that the use of these inputs should be intensified if the wheat grower want to improve their returns from this crop. Seed was found to be negatively significant. Rest of the variable turned out to be non-significant.

**SUMMARY**

The present study was conducted to examine employment and income generated on vegetable v/s wheat crop for small, medium and large Holding of Amritsar district (2015-2016). One hectare of land put under

**Table 4: Determinants of gross value product of Pea, cauliflower and wheat using linear production function**

Variables	₹		
	Pea	Cauliflower	wheat
Intercept	-56679.12** (15869.47)	-228623.86** (38986.03)	4774.65 (4805.43)
Area (ha)	61994.41** (3947.97)	65178.90** (5350.99)	2166.63* (1028.71)
Seed	-1.12 (0.68)	-0.91 (0.96)	-6.31* (3.18)
Age	26.21 (65.39)	181.62* (108.48)	2.01 (60.29)
Agronomic practices	-0.03 (0.44)	-0.19 (.85)	4.29** (1.36)
Hired labour (hr)	-55.16 (44.98)	-12.36 (49.91)	-4.74 (47.09)
Family labour (hr)	620.92** (117.35)	1440.19** (263.29)	-430.59 (957.41)
Irrigation	-5.82* (3.13)	-2.51 (1.57)	6.75** (1.88)
Manure and fertilizer	-1.51 (2.23)	-2.14*** (.98)	3.48** (1.08)
Plant protection	21.26** (7.78)	0.28 (3.14)	3.63 (4.08)
R <sup>2</sup>	.94	.85	.88

\*P<0.1, \*\*P<0.01 Level of significance

Figures in parentheses indicates the standard error

Cauliflower crop provided employment to the extent of (657 hours) per hectare as compare to pea (538 hours) per hectare and wheat (287 hours) per hectare. Cauliflower crop was the most employment generating crop in the sample district. The analysis reveal an average farm family spend ₹81651 per hectare as total variable cost for pea as compared to cauliflower (₹45603) and wheat (₹25934) per hectare. Seed (50.75 per cent) was the major component in case of pea, labour in case of cauliflower (28.13 per cent) and manure and fertilizer in case of wheat (28.69 per cent). The comparative analysis of the returns from vegetable and wheat crop reveals that pea yielded the maximum returns (₹70463) to the farmer followed by cauliflower (₹56265) and wheat (₹36870). Wheat was least paying crop to the farmer whereas pea was paying maximum and cauliflower was second in order. The regression analysis reveals that area, family labour and plant protection were found to the positively significant for pea. In case of cauliflower crop area, age of the respondent and family labour was positively significant and in case of wheat crop agronomic practices, irrigation, and manure and fertilizer were positively significant.

## **CONCLUSIONS**

Cultivation of pea and cauliflower per unit can provide better returns (almost double) than that of competing crop wheat. Employment generation is almost double for cauliflower than wheat. Picking of vegetables is one of the operations which provide employment to women and hence give them opportunity to earn that wheat cultivation cannot provide. Small and marginal farmers almost double their income by getting two successive cultivations of vegetable crops from same unit of land as vegetables are short duration crop.

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## Yield and Economic Analysis of Tamarind under Agroforestry System in Tamil Nadu to Enhance Farmers Income<sup>#</sup>

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### ABSTRACT

Agroforestry system with the integration of perennial woody trees is most suitable technology for increasing total productivity of food, feed, fuel and thereby reducing the risk of farming and increasing the income of farmers. This study analyses the economics and yield of tamarind under agroforestry system in Tamil Nadu. The major objectives of the study are to prepare the fruit yield table and analyze the economics of tamarind cultivation. Dindigul, Theni, Madurai and Krishnagiri districts were selected and 80 farmers were enquired. Fruit yield from the bearing till their economic yield stage and the cost and returns from tamarind were collected and fruit yield table was prepared. The calculated value of BCR, NPV and IRR are 3.20, 98164.48 and 24.6047 indicating the feasibility of tamarind cultivation.

### Keywords

Agroforestry, economics, establishment cost, maintenance cost, returns, tamarind, yield

### JEL Codes

P28, P47, Q23, Q 57

### INTRODUCTION

Agroforestry combines trees, shrubs, forages, grasses, livestock and crops in innovative and flexible combinations tailored to the needs of the farmers. This ensures sustained availability of multiple products as direct benefits such as food, vegetables, fruits, fodder, fuel, manure, medicine, timber etc. An area of 46.70 million ha has been estimated under wastelands, which is 14.75 per cent of the geographical area of the country. Agroforestry practices are considered as most vital and potential farming system for minimizing the land degradation and increasing the farm income. It enhances soil fertility, reduce erosion, improve water quality, enhance biodiversity, increase aesthetics and sequester carbon. Agroforestry always remain productive for the farmer and generates continuous revenue as per Kanaujia *et al.* (2009). With the shrinking per capita land availability, agroforestry system with the integration of perennial woody trees is most suitable technology for increasing total productivity of food, feed, fuel and thereby reducing the risk and increase the income from farming.

Fruit tree based agroforestry involves intentional and simultaneous association of annual or perennial crops with perennial fruit-producing trees on the same farm unit. Because of the relatively short juvenile phase of fruit trees, high market value of their products, and the contribution of fruits to household dietary needs, fruit needs, fruit-tree based agroforestry enjoys high popularity among resource limited producers worldwide. Fruit trees are efficient enough in providing higher economic return even under stressed growing conditions prevailing under the upland situations than the other annual crops. The summation of the component crops can increase the total productivity of the land where poor soil fertility coupled with low water holding capacity of the soil contributes towards low productivity of any crop in this region. Joshua & Dudhade (2006) investigated yield and value chain analysis of tamarind, the yield started in sixth year and the investment on establishment and aftercare of the orchard can be recovered by the eighth year. Sauce, pickle, toffee and dried pulp powder are the other products.

Tamarind is a common multipurpose tree in India. The

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name derived from the Arabic word “Tamare-hind” or “Tamarhindi” meaning Indian date, because its dark pulp resembles the preserved dates of Arabian countries. In Sanskrit called as “Amlika” meaning sour taste. It is a native of Eastern Tropical Africa. India is one of the largest producers of Tamarind in the world and it is the only country, which produces a commercial crop Tamarind. In India, Tamil Nadu, Madhya Pradesh, Andhra Pradesh, Maharashtra and Karnataka are the major Tamarind growing states. The fruits are used for various culinary purposes as they contain tartaric acid and the seeds give a gum used for binding. Tamarind classified based on their color, taste and place of origin.

#### **Tamarind cultivars are named based on their place of identification**

- 1 PKM-1 released by Horticultural college and Research Institute, Periyakulam, Tamil Nadu Agricultural University, during 1992. This clonal selection is an early bearer. The grafts of this variety come to flower third year as against fifth year in seedlings. It has a high pulp recovery of 39 per cent (compared to 28per cent in the local). Characteristic white color observed in the inner side of pulp indicating its superior quality. This selection has high tartaric acid (17.1per cent) and ascorbic acid (3.95mg/100g) contents. It is very high yielder with 263kg/ tree against 167kg/tree in local type accounting for an increase of 59 per cent over local type.
- 2 Urigam – superior local genotype located near Urigam, a small village near Thenkanikottai in Dharmapuri district in Tamil Nadu. It is short in size and branches out like umbrella. Pods are lengthy, fleshy and tasty. Pods are flat and exhibit a typical inward “C” shaped curvature. Flowering is slightly late, seen in March and Fruits are ready for harvest by July. Seedlings start bearing from 6-8 years, while grafts yield released from 4<sup>th</sup> year onwards.
- 3 Prathisthan – selection made at University of Agricultural Sciences, Dharwad. A sweet red type with an average yield of 1.5 kg/plant (dry).
- 4 DTS-1-A red pulped selection made by the forest department, Karnataka.
- 5 Other local selections are Cumbum from Madurai district of Tamil Nadu, Rahuri selection from Maharashtra, Kanagadevanapalli tamarind, Dever Ulimangalam tamarind and attractive red pulp ‘Yogeswari’. With the prevailing vast scope, the study was conducted with the following objectives:

- I. to prepare fruit yield table of tamarind and
- II. to analyze cost and returns of tamarind cultivation.

#### **METHODOLOGY**

##### **Sampling**

Purposive sampling method was adopted for selection

of districts with the criteria of maximum area under cultivation of tamarind tree species. Dindigul, Theni, Madurai and Krishnagiri districts together comprising 48 per cent of the state's area (season and crop report 2012-13) under tamarind was selected. In each tamarind growing district 20 farmers were selected and thus the total number of sample was 80 farmers. The details on the fruit yield of the trees from the bearing till their economic yield stage and the cost and returns were collected from the selected farmers. The required information was collected through personal interview method with the help of comprehensive pre-tested interview schedule.

##### **Tools - Percentage Analysis**

For making simple comparisons, details on yield and cultivation aspects of selected tree species will be analyze through simple percentage analysis.

##### **Fruit Yield Analysis**

The fruit yield data over the years from the initial bearing up to the economic yielding period was collected from the selected farmers for tamarind varieties in order to develop the fruit yield table. Technical information from the horticultural department was utilized to cross verify the yield data of prevailing varieties of the selected trees cultivated by the farmers. Then the fruit yield table was prepared by the post stratification of the sample farmers based on the yield trend. The data collected was divided into three phases viz, initial establishment period (0-6 years), second phase on the economic yielding period (7-12 years) and third phase is the stabilization of yield period(13-50 years). Above 50 years there is a decline in the fruit yield of trees. Since, fruit yield depends upon the resources applied and management practices followed, it becomes essential to analyze the cost involved and returns obtained from the trees.

##### **Cost and Returns**

The details of cultivation aspects of selected tree species including yield, cost and returns from each sample farmer for the past 12 years would be collected and tabulated. The establishment cost up to 6 years is considered as fixed cost and the maintenance cost up to 12 years period will be considered as variable cost i.e., the second phase and these costs would be apportioned to each year to get the cost and returns data for the years till the economic yield would be arrived for further analysis. The cost spreading over the years till the economic yielding period would help to get a feasible outcome while computing the NPV, BCR and IRR. In this study, cost and returns collected from the sample farmers would be tabulated and NPV, BCR and IRR would be computed to assess the worthiness of investment in tamarind.

##### **Net Present Value (NPV)**

$$NPV = \sum_{t=1}^n \frac{B_t - C_t}{(1+r)^t}$$

Where,

B<sub>t</sub> = Benefits in t<sup>th</sup> year

C<sub>t</sub> = Costs in t<sup>th</sup> year

n = Number of years

r = Discount rate

When NPV is greater than zero, the plantation practice is worthy. If NPV equals zero, the practice is neither worthy nor unworthy. If it is less than zero, the plantation will be unworthy. Among the different systems, one which is capable of generating the highest NPV is chosen.

**Benefit-Cost Ratio (B-C Ratio)**

It shows how much benefits can be generated per rupee of investment. The BCR is the ratio of sum of present value of benefit to sum of present value of cost for a given discount rate. If the B-C ratio is more than one, then it indicates the viability of investment. The Benefit-Cost ratio is mathematically expressed as:

$$\text{Benefit - Cost ratio} = \sum_{t=1}^n \frac{B_t / (1+r)^t}{C_t / (1+r)^t}$$

Bt = Benefits in t<sup>th</sup> year

Ct = Costs in t<sup>th</sup> year

n = Number of years

r = Discount rate

When Benefit Cost ratio is greater than one is beneficial. If it equals one, the cultivation is neither worthy nor worthy. If BCR is less than one, the cultivation will be unworthy.

**Internal Rate of Return (IRR)**

IRR is the discount rate which just makes the net present worth of cash flow equal to zero. The investment is considered viable if the calculated IRR is greater than that of the bank interest rate (opportunity cost of capital).

$$IRR = \sum_{t=1}^n \frac{(B_t - C_t)}{(1+r)^t}$$

Bt = Benefits in t<sup>th</sup> year

Ct = Costs in t<sup>th</sup> year

n = Number of years

r = Discount rate

When IRR is greater than the cut off rate (Bank Interest Rate) the cultivation is worthy. If IRR is less than the cut off rate, the system will be unworthy. Among the practices, the one capable of generating the highest IRR is favored. The cut off rate is the critical minimum rate of return desired, below which the practices may be improved to yield more or the cost of maintenance is reduced.

**RESULTS AND DISCUSSION**

**Social Attributes of the Tamarind Growers**

In the selected districts the social attributes of the tamarind growers were analyzed. The basic social variants such as age, educational status, family composition, farming experience, farming experience in tamarind cultivation and land holding were the major attributes discussed for the topic. These attributes play a major role in deciding the awareness and adoption of various technologies among the farmers. The results are presented in percentage and discussed in Table 1

The results furnished in the Table 1 show that 80 per cent of the heads of the sample households belonged to the

**Table 1: Social attributes of the tamarind growers (N=80)**

Particulars	Number	Percentage (per cent)
<b>Age (Years)</b>		
Below 35 (< 35)	-	0.00
35 - 45	16	20.00
Above 45(>45)	64	80.00
<b>Total</b>	<b>80</b>	<b>100</b>
<b>Educational status</b>		
Graduate/diploma	4	5.00
Higher secondary	11	13.75
High school	19	23.75
Primary	32	40.00
Illiterate	14	17.50
<b>Total</b>	<b>80</b>	<b>100</b>
<b>Family composition (No.)</b>		
Small (<7)	10	12.50
Medium (7-11)	73	91.25
Large (>11)	7	8.75
<b>Total</b>	<b>80</b>	<b>100</b>
<b>Farming experience (years)</b>		
	<b>Number</b>	<b>Percentage (per cent)</b>
Low (<30)	46	57.50
Medium (30-35)	24	30.00
High (>35)	10	12.50
<b>Total</b>	<b>80</b>	<b>100</b>

age group of above 45 years. The literacy levels of heads of sample households are presented and it could be observed that the illiterates accounted for 17.50 per cent and majority of sample farm households having primary education was found to be 40 per cent. The mean of the data on family size could be seen among the tamarind producing sample farm households, 91.25 per cent belonged to medium sized family with a family size of five to seven persons. It could be inferred from the table that 70.00 per cent had the experience of less than 45 years in farming, and 76.25 per cent of the farmers have an experience of 7-11 years in tamarind cultivation. The results convey that around 42.50 per cent of the farmers were small farmers with less than 8 acres.

**Annual Yield Table for Tamarind Fruits (Kg)**

In Dindigul district, total area is 3194 Ha and total production is 17632 Mt. Sanarpatti and Natham blocks are the highest production area for Tamarind. In this area all are planted local varieties with the spacing of 8m×8m and 10m×10m. In Krishnagiri district, total area is 3434 Ha and Total production is 21847 Mt. Uthangarai, Thally and Veppanapally are the highest production areas viz., 145, 141, and 161 ha. In this area, local varieties and Urigamvatiety are planted with the spacing of 8m×8m and 10m×10m. In Madurai district, total area is 1297.550 ha. Kottampatti and Alanganallur are the highest production areas viz., 663.610 ha and 276.145 ha. In this area, local varieties are planted with the spacing of 8m

Table 2: Yield table of Tamarind fruit

Age	(Kg/year)							
	Dindigul		Krishnagiri		Madurai		Theni	
	Tree	Acre	Tree	Acre	Tree	Acre	Tree	Acre
11	25	1000	38	1500	20	800	25	1000
12	38	1500	50	2000	30	1200	38	1500
13	45	1800	90	3600	45	1800	50	2000
14	50	2000	105	4200	55	2200	70	2800
15	65	2600	125	5000	63	2500	88	3500
16	75	3000	150	6000	70	2800	75	3000
17	80	3200	165	6600	75	3000	88	3500
18	95	3800	200	8000	88	3500	75	3000
19	110	4400	205	8200	93	3700	88	3500
20	125	5000	220	8800	100	4000	100	4000
21	140	5600	225	9000	110	4400	105	4200
22	150	6000	240	9600	120	4800	115	4600
23	160	6400	250	10000	130	5200	125	5000
24	170	6800	260	10400	140	5600	150	6000
25	175	7000	270	10800	150	6000	163	6500
26	185	7400	275	11000	160	6400	175	7000
27	190	7600	290	11600	170	6800	200	8000
28	200	8000	300	12000	180	7200	213	8500
29	215	8600	310	12400	190	7600	225	9000
30	225	9000	325	13000	200	8000	250	10000

x8m and 10 m x 10m. In Theni district, total area is 2270.4 ha, total production is 6992 Mt. Periyakualm and Cumbum are the highest production areas viz., 329.34 and 1158.41ha. In this area, local varieties are planted with the spacing of 8m×8m and 10m×10m respectively.

The perusal of Table 2 shows that, in tamarind economic yield starts from 10<sup>th</sup> year onwards. In these study areas, yield might be varying due to soil and climatic conditions. From 11<sup>th</sup> year onwards yield increases gradually till the attainment of 30 years and in some areas 40 years, then the yield showed a gradual declining trend.

#### Establishment Cost of Tamarind

The total life of *tamarind* orchards can be divided into two stages, i.e. establishment period and maintenance period. From eleventh year onwards fruit bearing commences in tamarind trees. The period from preparation of the field until bearing of fruit is known as establishment period. The *tamarind* orchardists have to invest considerable amount of money on establishment of the orchards from the initial year to the age of bearing. During this gestation period (usually ten years) the orchardist does not get any return from the tree in the form of fruits. The investment made by the farmer in the establishment of orchard from the pre planting stage to the

first flowering stage is categorized as capital investment.

The results presented in Table 3 showed that ploughing cost was ₹1000 per acre (4.63 per cent), bund formation ₹1500 per acre (6.94 per cent), Pitting ₹800 per acre (3.70 per cent), planting material ₹500 per acre (2.31 per cent), planting ₹1000 per acre (1.39 per cent), gap

Table 3: Establishment cost of Tamarind

Particulars	(₹/acre)	
	Amount	Percentage
<b>Cost of Establishment (Upto 10 years)</b>		
Ploughing	1,000.00	4.63
Bund formation	1,500.00	6.94
Pitting	800.00	3.70
Planting material	500.00	2.31
Sowing/Planting	1000.00	1.39
Gap filling	150.00	0.69
Fertilizer / Manuring	3,600.00	16.67
Irrigation	7,200.00	33.33
Weeding	6,550.00	30.32
Pruning	0.00	0.00
Pesticide application	0.00	0.00
	<b>21,600.00</b>	<b>100.00</b>

Table 4: Maintenance cost of Tamarind

							(₹/acre)
<b>B. Maintenance cost</b>		<b>11-15</b>	<b>16-20</b>	<b>21-25</b>	<b>26-30</b>	<b>Total</b>	<b>Percentage</b>
1	Weeding and earthing up	2900.00	3700.00	2400.00	0.00	9000.00	3.57
2	Manuring	0.00	0.00	0.00	0.00	0.00	0.00
3	Fertilizer	0.00	0.00	0.00	0.00	0.00	0.00
4	Irrigation	0.00	0.00	0.00	0.00	0.00	0.00
5	Plant protection	0.00	0.00	0.00	0.00	0.00	0.00
6	Pruning	0.00	0.00	0.00	0.00	0.00	0.00
7	Harvesting	24400.00	54050.00	75850.00	88750.00	243050.00	96.43
<b>B. Maintenance cost</b>		<b>27300.00</b>	<b>57750.00</b>	<b>78250.00</b>	<b>88750.00</b>	<b>252050.00</b>	<b>100.00</b>
<b>Total cost (A+B)</b>						<b>273650.00</b>	
Yield (Kg)		8900	19400	31800	40600	100700	
Tamarind ₹/Kg with pod						15	
Income		133500.00	291000.00	477000.00	609000.00	1510500	
Net income		106200.00	233250.00	398750.00	520250.00	1236850	
						BCR	3.20
						NPV	98164.48
						IRR	24.6047

filling ₹150 per acre (0.69 per cent), fertilizer and manuring ₹3600 per acre (16.67 per cent), irrigation ₹7200 per acre (33.33 per cent), weeding ₹6500 per acre (30.32 per cent). The total establishment cost up to 10 years was ₹21,600 per acre.

The perusal of Table 4, shows that the Weeding and earthing up cost was ₹9000 (3.57 per cent) and harvesting cost ₹243050 (96.43 per cent). The total maintenance cost was ₹252050. The total cost mounted to ₹273650 per acre. The calculated value of BCR, NPV and IRR was 3.20, ₹98164.48 and 24.6047

#### CONCLUSIONS

Tamarind cultivation in agroforestry system has been found to be feasible indicated by the NPV, BCR and IRR values. The farmers adopting this cultivation in the study area were found to be marginal and small farmers of middle and above middle age groups having sufficient

number of years of experience and literacy level. The cultivation of hard wood trees in agroforestry system, especially tamarind as taken up for research has indicated that it would be profitable. Farmers are cultivating this tree crop in marginal lands and with minimum resource utilization earning better income under vulnerable conditions also. This type of land use has to be promoted by the governments and organizations for enhancing tree cultivation, increasing green cover and better income to farmers.

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## **Growth of Area, Yield and Agricultural Production in Punjab (1961-2015) -A Case for Diversification for Better Returns and Agricultural Sustainability**

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### **ABSTRACT**

*This paper briefly outlines the performance of agricultural sector in Punjab since 1960-61 to 2014-15. It tries to highlight the reasons for emergence of low returns and high costs of cultivation in the state. The compound annual growth rate of area, yield and production of various crops has been worked out to see the trends in yield and area and its impact on crop production. Index of diversity has also been worked out for various sub-periods under study. The paper highlights the problems and challenges that concern the agriculture sector of the economy and suggests the needed measures in order to make Punjab agriculture ecologically viable and economically remunerative.*

### **Keywords**

Agriculture, government policy, land, water

### **JEL Codes**

Q13, Q24, Q25, Q38

### **INTRODUCTION**

Agriculture is the backbone of the Indian economy. It not only provides food security and employment to a majority of population but also contributes to the growth of non-agriculture and trade sector through its forward and backward linkages. However, the performance of agriculture sector in India is deteriorating day by day. Farmers in India are grappling with low crop and labour productivities, rising costs of production, higher weather and market vulnerability and deteriorating soil quality. There are incidences of farmers' suicides even in the most prosperous agricultural regions of India. Farmers' dependence on moneylenders is on increase. Realizing all these problems, Prime Minister Narendra Modi expressed his desire to double the income of farmers by the year 2022. This sensational statement evoked strong responses from various analysts, experts and the media.

Doubling farmers' income in five years span (in nominal terms), is not something which we cannot achieve. What we need to address is to make agriculture a remunerative professional options for majority of the Indians. Another bigger challenge is to ensure sustainability of agriculture i.e. to maintain of the quantity, as well as the quality of agricultural produce

over very long periods of time without signs of fatigue in productivity gains (Shiva, 1991). Moreover, not every agricultural region in India is suffering from same set of problems, so there cannot be only one remedy to all problems. We need to devise and implement region-specific plans.

Here in this paper our focus is on agricultural economy of Punjab. Punjab- the most prosperous agricultural region of India which now has become a victim of its own choices and mindless agricultural policies.

### **AGRICULTURAL ECONOMY OF PUNJAB (1960-61 to 2014-15)**

The Punjab agriculture is known for its excellent performance of agriculture due to the adoption of new technology in the late 1960s, and early 1970s. This 'land of five rivers' as the very name suggests, has utilized its natural resources and fertile soils to the best since the ancient times and established itself as an agriculturally developed region. The economic transformation of rural Punjab owes very heavily to the transformation of its agriculture (Chadha, 1986). The chief-granary of India, which pulled country back from the brink of mass-starvation through its green revolution in the background of its strong agricultural infrastructure base, could not be

sustained the momentum of green revolution for long.

The economy which grew at a rate almost one and a half to two times higher than the rate of growth of the rest of India in two decades (70s to 80s), its growth rate slipped to 4.13 per cent, significantly lower than all India average of 6.1 percent from 1993-94 to 2002-03. It was just ahead of Orissa and Bihar at the bottom. The growth rate of Punjab agriculture has also slowed down significantly since 1993. For the period 1993-94 to 2002-03 it registered an annual growth rate of 2.15 per cent well below the national level average of 5.35 per cent relative to the rate of 7.4 per cent in 1960 and 5.4 per cent in 1980s. According to the Economic Survey of Punjab 2003-04, the primary sector of the state has registered a negative growth at the rate of -2.38 percent over the preceding year 2002-03. During the period from 2004-05 to 2013-14 it grew at an annual compound growth rate of 1.38 per cent compared to a CAGR of 4.10 percent at national level.

Table 1 presents the compound annual growth rates of Agricultural GSDP and GSDP-Punjab State and compare these with national level figures for various years.

The share of the agricultural sector in the gross state domestic product (at constant prices) also declined significantly from 26.67 per cent in 1990-91 to 23.47 per cent in 2003-04 (GOP, 2004). This share further dipped to 19.73 per cent in 2011-12, and 16.07 per cent in 2013-14. More shockingly, agriculture sector of Punjab grew at a rate of -0.05 and 0.21 per cent in the years 2012-13 and 2013-14 compared to 4.93 per cent at the national level in 2013-14.

#### Shifts in the Cropping Pattern of Punjab (1961-2015)

An analysis of cropping pattern in Punjab (Table 2) shows that agriculture economy of Punjab is dominated by wheat and paddy rotation. Before green revolution significant amount of gross cropped area was under grams, pulses, cotton maize and cereals other than wheat

**Table 1: Growth of agricultural GSDP and GSDP in Punjab**

Period	(Per cent)			
	Punjab State		India	
	Agricultural GSDP	GSDP	Agricultural GDP	GDP
1983-84 to 1993-94(at 1980-81 prices)	4.62	5.13	3.05	2.19
1993-94 to 2003-04(at 1990-91 prices)	2.15	4.13	5.32	6.01
2005-06 to 2013-14(at 2004-05 prices)	1.38	6.73	4.10	7.59

Source: Author's calculation based on data taken from Statistical Abstracts of Punjab and Agricultural Statistics at Glance (Central Statistical Organisation)-Various Years, Planning commission of India, CSO, Ministry of Agriculture, Government of India, New Delhi

**Table 2: Cropping pattern of Punjab (1961-2015): Area under various crops as percentage to GCA**

Year	(Per cent)							
	1960-61	1966-67	1980-81	1990-91	2000-01	2005-06	2009-10	2004-15
Rice	5.90	6.70	20.22	30.54	37.20	37.58	38.89	40.22
<b>Rice**</b>	<b>17.03</b>	<b>16.68</b>	<b>48.19</b>	<b>66.14</b>	<b>76.84</b>	<b>76.56</b>	<b>79.51</b>	<b>81.75</b>
Jowar	0.23	0.14	0.02	0.01	0.01	0.00	0.00	0.00
Bajra	3.21	4.33	1.18	0.18	0.09	0.07	0.04	0.00
Maize	8.44	10.44	6.53	2.85	2.34	2.11	1.93	1.75
Groundnut	1.73	4.21	1.42	0.17	0.06	0.05	0.04	0.01
Sesame	0.21	0.47	0.29	0.27	0.27	0.16	0.08	0.07
Cotton	11.55	10.23	11.09	10.63	6.74	7.92	7.09	5.84
Sugarcane	3.39	3.67	1.21	1.53	1.72	1.19	0.83	1.31
Wheat	36.09	37.83	48.06	49.61	48.54	49.33	48.88	48.71
<b>Wheat**</b>	<b>55.41</b>	<b>63.61</b>	<b>83.79</b>	<b>92.77</b>	<b>95.78</b>	<b>96.90</b>	<b>97.64</b>	<b>98.21</b>
Barley	1.66	2.45	1.11	0.56	0.46	0.27	0.19	0.15
Gram	22.55	14.91	4.41	0.91	0.11	0.06	0.04	0.03
Other pulses	1.99	1.36	1.42	1.26	0.67	0.30	0.21	0.15
Sunflower	0.00	0.00	0.00	0.08	0.10	0.25	0.31	0.13
Rape-mustard	2.74	2.80	2.32	1.05	0.78	0.70	0.43	0.43
Potatoes	0.21	0.33	0.68	0.35	0.91	0.00	1.03	1.20
<b>Rice and Wheat</b>	<b>41.99</b>	<b>44.53</b>	<b>68.28</b>	<b>80.15</b>	<b>85.74</b>	<b>86.92</b>	<b>87.77</b>	<b>88.94</b>
GCA	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Rice\*\* is the area under rice as percentage to area under Kharif crops. Similarly Wheat\*\* is the area under wheat as percentage to area under Rabi crops

and paddy, it was around 56 at the advent of green revolution in 1966-67. Diversity was a central principle of traditional agriculture in the Punjab, which contributed to ecological stability of the state in past. Green revolution replaced mixtures and rotations of crops with monocultures of wheat and rice and crops other than these two started disappearing. Wheat gained area mainly at the cost of gram, barley, rapeseed and mustard. It currently occupies 98 per cent of the area under *Rabi* crops. Similarly, the area under rice increased at the cost of maize, groundnut and cotton. It occupies 82 per cent of the area under *kharif* crops presently. Both crops put together cover 89 per cent of the area under gross cropped area (GCA) in 2014-15. Between 1967-68 to 2000- 01, the area under rice kept on increasing and afterwards started fluctuating, shown by wheat crop (Figure-A).

Simpson Index of diversity (SID) has been used to measure the extent of diversity in the crop sector of Punjab. This index is a deviation of Herfindal Index of diversity from Unity. It ranges between zero and one. If there exists complete specialization, index moves towards 0. Results presented in Table 3 showed that diversification in the crop sector has declined over the period (1961-2015) i.e. economy is getting specialized in few crops only. Year 2001-02 is the only exception when cropping sector moved a little towards diversification but again reverted back to follow the same trend.

From Table 2, we know that wheat and paddy are two crops which dominate the crop sector of Punjab, and determine the fate of agricultural economy of the state.

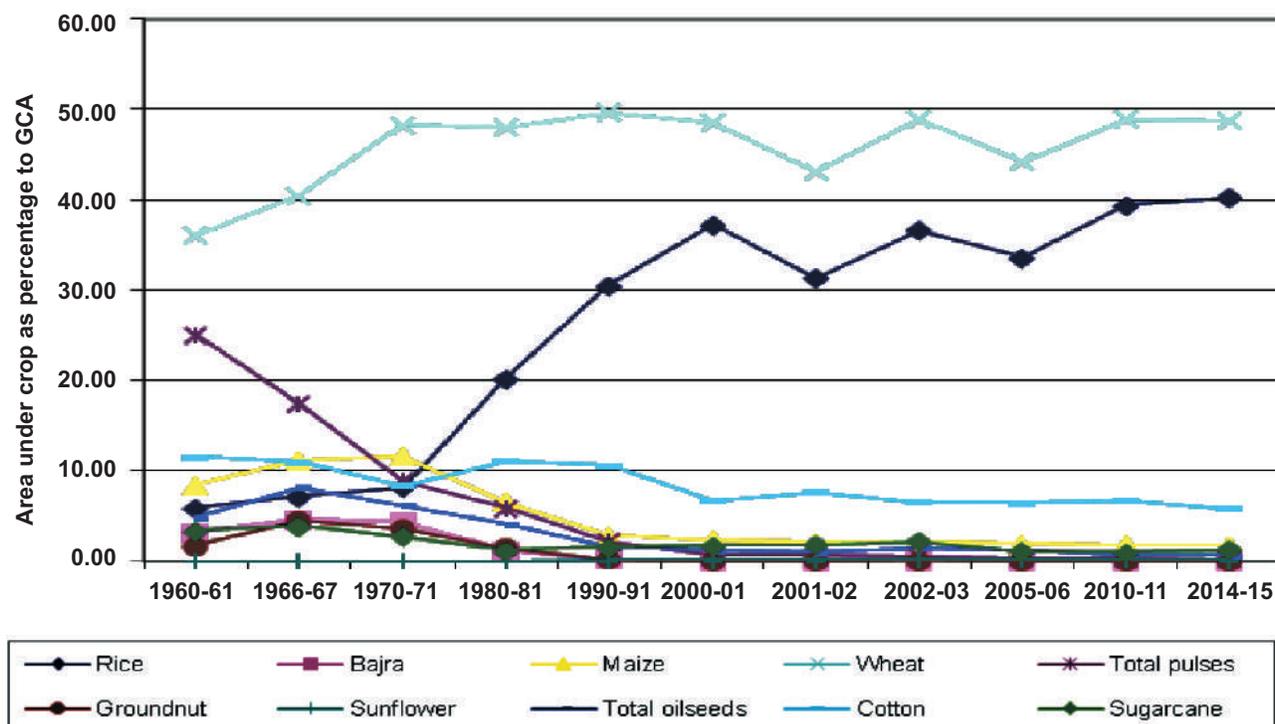
**Table 3: Index of diversity**

Year	Simpson index of diversity
1960-61	0.791
1970-71	0.729
1980-81	0.708
1990-91	0.648
2000-01	0.620
2001-02	0.631
2002-03	0.621
2010-11	0.600
2014-15	0.596

Yield and production of the crops determine the income of the farmers. Let us now see what has happened to yield and production of various crops in Punjab and wheat-paddy in particular.

With this purpose in hand, Compound Annual Growth Rates (CAGR) of area, production and yield of various crops in Punjab have been worked out using semi log-linear function of the form  $(\log y=a+bt)$ . As growth of the cropped area and its yield are the two main factors responsible for the growth in production, results are interpreted in this form only. Based on the results, thirteen individual crops and four crop groups under analysis are divided into four categories (Table 4). These categories are as follows-

**Category I:** Crops showing positive significant growth in the production due to positive significant growth in cropped area as well as yield per hectare



**Figure A: Changes in the cropping pattern Punjab (1961-2015)**

**Category II:** Crops showing positive growth in the production due to positive significant growth in cropped area but yield per hectare is either non- significant or negative significant.

**Category III:** Crops showing positive significant growth in the production due to positive significant growth in yield per hectare but growth in cropped area is either non-significant or negative significant.

**Category IV:** Crops showing negative significant growth in the production

In Category-I we have crops like rice, wheat, total cereals, cotton and potatoes. These crops have shown positive significant growth in the production due to positive significant growth in cropped area as well as yield per hectare. Yield of rice and wheat has picked up with the introduction of HYV in 1966-67, which motivated the farmers to bring more area under these crops, despite the fact that yield growth has come down drastically after 1980s. Total cereals are following the trends of wheat and paddy only as other cereals occupy very small amount of area under GCA. Cotton has also shown increase in output due to positive growth of area and yield both for the period 1961-2015. However it has shown a statistically significant area decline during the period 1991-2015, while the yield growth also showed a downward trend, affecting its production largely (See Table 5).

In Category II we don't have any crop as no individual

**Table 4: Growth of area, production and yield of various crops in Punjab**

Crops	Production	Area	Yield
<b>Category I</b>			
Rice	2.33	1.76	0.72
Wheat	1.06	0.47	0.71
Total cereals	1.11	0.55	0.72
Cotton	0.56	0.06(NS)	0.57
Potatoes	1.77	2.66	0.22
<b>Category III</b>			
Sugarcane	0.18	-0.34	0.31
<b>Category IV</b>			
Bajra	-6.75	-7.09	0.45
Maize	-0.31	-1.15	0.62
Barley	-0.18(NS)	-2.35	1.00
Gram	-8.88	-9.28	0.26
Other pulses	-1.18	-1.58	-0.33
Total pulses	-3.96	-3.72	0.03(NS)
Groundnut	-7.94	-8.26	0.15
Sesame	-1.79	-0.95	-0.11
Sunflower	-3.04	-4.13	0.26
Rapeseed & Mustard	-0.35(NS)	-1.40	0.68
Total Oilseeds	-1.03	-1.57	0.39

Source: Authors' calculation based on data compiled from Statistical Abstracts of Punjab- Various Issues

**Table 5: Classification of crops based on growth of area, production and yield in Punjab for different sub- periods**

Crop category	1961-66	1967-80	1981-90	1991-2015	1961-2015
Category -I	Rice, Maize, Wheat, Total Cereals, Groundnut, Sesame, Total Oilseeds, Cotton, Sugarcane, Potatoes	Rice, Wheat, Total Cereals, Cotton, Potatoes	Rice, Wheat, Pulses other than gram, Total cereals, Rapeseed & Mustard, Sugarcane, Cotton, Sugarcane	Rice, Wheat, Total Cereals, Potatoes	Rice, Wheat, Total Cereals, Cotton, Potatoes
Category -II	Bajra				
Category -III	Barley, Rapeseed & Mustard	Pulses other than grams, Rapeseed & Mustard, Sugarcane		Maize, Cotton	Sugarcane
Category IV	Grams, Pulses other than grams, Total Pulses,	Maize, Bajra, Barley, Grams, Total pulses, Groundnut, Sesame, Total Oilseeds,	Maize Bajara, Barley, Grams, Total Pulses, Groundnut, Total Oilseeds, Sesame, Potatoes	Bajra, Barley, Grams, Pulses other than grams, Total Pulses Groundnut, Sesame, Sunflower Rapeseed & Mustard, Total Oilseeds, Sugarcane	Bajra, Maize, Barley, Grams, Pulses other than grams, Total Pulses Groundnut, Sesame, Sunflower Rapeseed & Mustard, Total Oilseeds

Source- Authors' calculation based on data compiled from Statistical Abstracts of Punjab- Various Issues

crop or crop group under analysis (for the period 1961-2015) has shown positive growth in the production due to positive significant growth in cropped area while yield per hectare was either non- significant or negative significant. Still when we are dividing the period in different sub-periods, bajra enters this category for the period 1960-61-1966-67 when despite having negative growth in the yield it showed positive output growth due to increase in the cropped area. Till 1980 cropped area grew under this crop but yield decline affected the output and after 1980-81 cropped area also started declining. It has completely vanished from the cropping scene of Punjab in 2014-15.

In Category III we have only one crop i.e. sugarcane. It has shown positive significant growth in the production due to positive significant growth in yield per hectare but growth in cropped area has remained negative significant. Sub period analysis shows that growth in area under sugarcane has kept on fluctuating. It declined immediately after sudden focus on wheat and paddy in 1966-67 then increased at positive rate during 80s again and then grew at a negative rate after 1990-91 despite a positive growth in its yield in almost all sub-periods. Price fluctuations and delayed payment by the mill owners appear to be two such factors which have caused dis-interest among the farmers for this crop.

Sub- period analysis showed that barley, rapeseed & mustard (1960-61 to 1966-67); pulses other than grams, rapeseed & mustard and sugarcane (1967-68 to 1979-80); Maize and cotton (1990-91 to 2014-15) have also shown

area decline despite having positive yield and production growth in different sub periods. Though the yield growth of these crops is positive, it is much less in comparison to that of wheat and paddy. Another important reason is lack of attractive and remunerative MSPs, which combined with comparatively low yield, do not lead to returns comparable to that of wheat and paddy.

In Category IV we have bajra, maize, barley, grams, pulses other than grams, total pulses groundnut, sesame, sunflower, rapeseed, mustard and total oilseeds. All these crops have shown negative growth in production. These are the crops where yield is comparatively less than that of wheat and paddy, thus are unable to compete in terms of cost and returns. Jowar, Bajra, grams, groundnuts, linseeds, have vanished off almost completely from the cropping scene of Punjab.

#### **Problems Associated with Singular Dependence on Wheat and Paddy Rotation-**

Wheat and paddy mono-culture has dominated the agricultural economy of the state since green revolution because of comparatively high yield and least production risk in the face of assured irrigation facilities and procurement by government at the minimum support prices and comparative advantage of cultivation of these two crops. Wheat and paddy monoculture has resulted into serious problems such as-

1. Water table has gone down drastically which has resulted in huge social and opportunity costs (see Chart-1)

**Chart 1: High water requirements of rice-Associated social and economic costs**

Crop category	1961-66	1967-80	1981-90	1991-2015	1961-2015
Category -I	Rice, Maize, Wheat, Total Cereals, Groundnut, Sesame, Total Oilseeds, Cotton, Sugarcane, Potatoes	Rice, Wheat, Total Cereals, Cotton, Potatoes	Rice, Wheat, Pulses other than gram, Total cereals, Rapeseed & Mustard, Sugarcane, Cotton, Sugarcane	Rice, Wheat, Total Cereals, Potatoes	Rice, Wheat, Total Cereals, Cotton, Potatoes
Category -II	Bajra				
Category -III	Barley, Rapeseed & Mustard	Pulses other than grams, Rapeseed & Mustard, Sugarcane		Maize, Cotton	Sugarcane
Category IV	Grams, Pulses other than grams, Total Pulses,	Maize, Bajra, Barley, Grams, Total pulses, Groundnut, Sesame, Total Oilseeds,	Maize Bajara, Barley, Grams, Total Pulses, Groundnut, Total Oilseeds, Sesame, Potatoes	Bajra, Barley, Grams, Pulses other than grams, Total Pulses Groundnut, Sesame, Sunflower Rapeseed & Mustard, Total Oilseeds, Sugarcane	Bajra, Maize, Barley, Grams, Pulses other than grams, Total Pulses Groundnut, Sesame, Sunflower Rapeseed & Mustard, Total Oilseeds

2. Agro-eco system of the state has become extremely fragile
3. Increased water-logging and salinity in south west Punjab:
4. Soil toxicity due to over use of chemicals and pesticides
5. Environment Pollution due to burning of straw and drastic reduction in organic matter content in the soil
6. Deterioration of soil health- deficiency of micro-nutrient in the soil
7. Development of new bio-pests and weeds
8. Increased incidences of pests and diseases
9. Deficient supply of pulses, vegetables and fruits
10. Increased cost of cultivation and low returns

Dev and Rao (2010) have calculated trend growth rates for costs of cultivation per hectare for wheat and paddy using data provided by Commission for Agricultural Costs and Prices (CACPC) which are presented here in the form of Figure 2. One can easily observe that the costs of cultivation for rice and wheat (at constant prices) has risen abundantly in Punjab between 1993-94 and 2007-08.

According to the recent report of Anonymous (2014) ratio of GVO and cost of cultivation in Punjab is 2.49 and 2.26 in *kharif* and *rabi* season compared to 2.61 and 2.46 at all India level. While cost of cultivation is on increase, returns from the crops have started declining in Punjab. According to same survey report, the real income of Punjab farm households has grown at an annual rate of 5.3

per cent between 2002-03 and 2012-13. It is much less than that of Haryana (8.3 per cent), Rajasthan (8.1 per cent), Orissa (7.6 per cent), Madhya Pradesh (6.91 per cent) and Andhra Pradesh (5.45 per cent). According to this survey, average earning from farming of a farm household in Punjab is ₹1,30,163 per year, which is highest among all Indian state but is just ₹10,847 a month. If we take total income of the farmer household in Punjab it is ₹217450 per year and not more than ₹18121 a month (Table 6).

Even a peon of a government office earns more than ₹18,000 per month. Good returns from farming are essential not only for the survival of farmers but also to facilitate reinvestment in agriculture. If the flow of income from crop cultivation is not regular and inadequate, farmers will have to depend upon debts. Due to low returns, farmers may not be able to repay their debts which would lead to increased indebtedness (Darling, 1925; Anonymous, 2005b; Narayanamoorthy & Kalamkar, 2005; Anonymous, 2007; Reddy & Mishra, 2009; Deshpande & Arora, 2010).

According to 70<sup>th</sup> round of NSS survey, around 53 per cent of the farm households in Punjab are in debt in 2012-13, while this figure was 49 per cent in 2002-03. Findings show that 40 per cent of the farm households in the state earn an income which is below poverty line of the state.

Now a billion dollar question is who is responsible for all this? There are many factors which can be held responsible for the plight of farmers in the state i.e.

1. Past policies of the government especially the

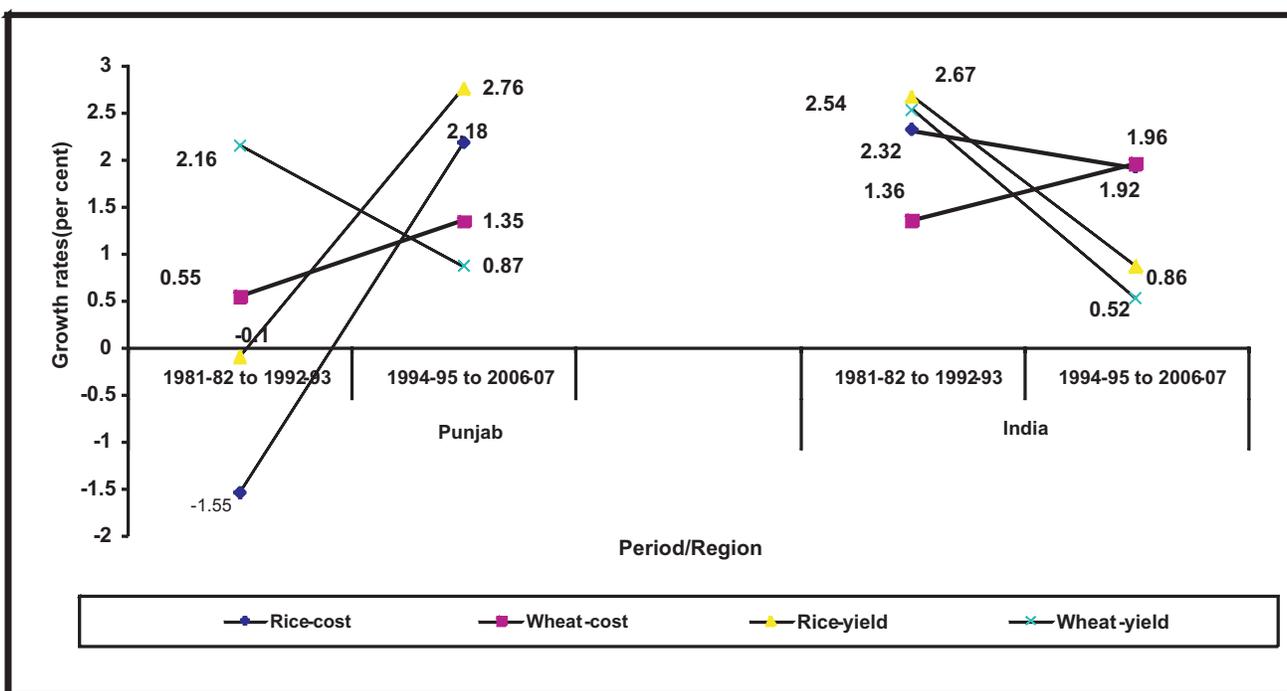


Figure B: Trend growth rate of costs and yields in rice and wheat-Punjab v/s India

**Table 6: Economics of cultivation (2012-13)**

Particulars	Punjab		Haryana		India	
	<i>Kharif</i>	<i>Rabi</i>	<i>Kharif</i>	<i>Rabi</i>	<i>Kharif</i>	<i>Rabi</i>
Total cost	76666	65066	41527	34722	15656	14928
Returns	114597	82271	68286	65443	25165	21817
Ratio of GVO/Cost	2.49	2.26	2.64	2.88	2.61	2.46

Source: Anonymous (2015)

2. Food security policies which care only about cereal production and procurement
3. Ignorance of the farmers and failure of the government to educate them. Government has failed to educate farmers about soil types and long term consequences of using higher doses of chemicals and pesticide on soil and human health.
4. Overly dependence of farmers on wheat –paddy rotation and lack of economically viable alternatives.
5. Non- availability of assured procurements and markets for crops other than wheat-paddy.
6. Low yield of alternative crops and high risks involved in the absence of insurance facilities

In year 2002-03, Govt. of Punjab launched its unique model of Contract Farming “Multi-crop, Multi-Year Contract Farming Scheme” to give boost to diversification of agriculture in Punjab, with the help of Punjab Agro Food grain Corporation (PAFC) as its nodal agency. Under this scheme, farmers were promised to be provided with high yielding varieties of seeds, technical supervision and follow-up on agronomic practices and buy-back of the entire produce with returns comparable to / better than wheat-paddy.

The scheme did not do well; however, in its first year (i.e. in 2003-04) many farmers of the state experimented with new crops such as basmati, hyola, durum wheat along with sunflower, moong, maize etc. They were quite satisfied with the yield and returns; however there was unhappiness because of non-procurement, poor implementation, harassment at the time of sale to contract agency and marketing problem in case of basmati. Few reported other problems such as- problems regarding extension services, payments, grading, quality of input (seed) supplied, registration fees and supply of input. A field survey (Kaur, 2005) done in year 2003-04 showed that around 50 per cent of the respondents from three districts of Punjab actually waited for the contract agency people for the renewal of contract but no one approached them.

This small illustration made here shows that farmers of Punjab are ready to diversify their cropping pattern given the option. If assured procurements and markets for alternative crops will be made available, cropping pattern will change for sure.

#### CONCLUDING REMARKS

So far as the economics of wheat –paddy is

concerned no other crop in the state is able to compete with wheat and paddy on assured profitability grounds, in these circumstances farmers will not choose any other crop over wheat- paddy. In other words- why a person will shift to a profession with low salary, if you want to hire him, you need to pay him high to lure him. Since diversification is the key to bring a positive change in the Punjab economy, we need to ensure the profitability of alternatives available. Alternatives could be of any type- diversification within crops or diversification within agriculture. Crop diversification demands yield improvements and assured markets for alternative crops. Beyond crop- alternative, major possibility exists in diversifying through development of livestock enterprises - milk and milk products. For these perishable things, establishment of private enterprises and processing plants should be encouraged by the government so that production on the basis of contractual arrangements can ensure remunerative returns to the producers. Contract enforcement is the area where presence of the government is actually needed.

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## Doubling of Farmer's Income by Vegetable Crop Production under Polyhouse

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### ABSTRACT

This study aimed to economic analysis of different cropping rotation of vegetables under polyhouse in Haryana (India). The overall findings of the study revealed that the cost of cultivation of tomato-cucumber, capsicum-cucumber and cucumber-cucumber-cucumber rotation under polyhouse was ₹607720.36, ₹581816.43 and ₹849876.2 per acre, respectively. Present study concluded that gross return was highest in crop rotation of cucumber-cucumber-cucumber with ₹12,56,034 per acre followed by tomato-cucumber (₹8,99,444.4) and capsicum-cucumber (₹877430.5), respectively while net return was ₹406157.8, ₹291724.03 and ₹295614.06, respectively.

### Keywords

Crop rotation, polyhouse, returns, vegetable

### JEL Codes

C83, D24, E43, O13, Q12, Q28

### INTRODUCTION

India is the second largest vegetables producer in the world next to China. In, 2012-13 the vegetable crops in India occupy only 2.8 per cent of the total cultivated land, producing 162.19 million metric tonnes of vegetables annually from a cropped area of 9.21 million hectares while in 2013-14, the area of vegetables in Haryana was 373.17 thousand hectares with 5.5 lakh tonne production (Anonyms, 2014-15). Tomato (*Lycopersicon esculentum*) is one of the most important protective food crops of India. India ranks second in the area as well as production of tomato next to China. Capsicum (*Capsicum annum*) is also called as bell pepper or sweet pepper is one of the most popular and highly remunerative vegetable crops. Capsicum is cultivated in most parts of the world, especially in temperate regions of Central and South America and European countries, tropical and subtropical regions of Asian continent mainly in India and China. Cucumber (*Cucumis sativus* L.) is known as *kheera* in Hindi. It is also an important summer vegetable crop, grown throughout India. It has a cooling effect, prevents constipation, useful in jaundice and its seeds have a great importance in Ayurveda. The cucumber is a warm season crop and grows best at a temperature between 18°C and

24°C.

Khakbazan *et al.* (2010) shows the relative economic return for six crop rotations during the initial 8 years after rotations were imposed. The Potato-Canola (P-C) rotation generated higher net income, but the results indicated that the Potato-Canola-Wheat rotation was also among the higher-revenue generating rotations. In the present paper, an attempt has been made to doubling of farmer's income by vegetable crop production under polyhouse.

### MATERIAL AND METHODS

The primary data was collected in 2013-14 in Karnal district of Haryana (India). To fulfil the specific objective of the study, the primary data was collected by personal interview of the selected respondent with the help of well-designed and pretested schedule. To collect the primary data, multistage random sampling technique was used. Karnal district was purposely selected based on predominance of vegetables cultivation under polyhouse. Gharaunda and Indri blocks were selected based on predominance in vegetable cultivation under polyhouse. There after two villages from each block were selected. Ten respondents from polyhouse were randomly selected from each village, thus a total of 40 respondents were

interviewed for present study. Simple statistical tools like averages and percentages were used to compare, contrast and interpret results properly. In the present study three crop rotations namely, tomato-cucumber rotation (R<sub>1</sub>), capsicum-cucumber rotation (R<sub>2</sub>) and cucumber-cucumber-cucumber rotation (R<sub>3</sub>) were analysed. In first rotation R<sub>1</sub>, tomato was grown in rabi season and cucumber was grown in kharif season. In this cropping pattern, generally tomato was planted in August-September and prolongs up to March. Himshona and Himshikhar varieties of tomato were grown by the respondents in polyhouse. Cucumber was planted in April and prolongs up to June. Generally, Hiltan and Multistar varieties of cucumber were cultivated. In the case of second crop rotation R<sub>2</sub>, capsicum was planted in August-September and prolongs up to March. Indra and Royal-wonder varieties of capsicum were grown by the respondent farmers in polyhouses. Similarly, cucumber planting was done in April and prolongs up to June. While in third crop rotation R<sub>3</sub>, three crops of cucumber were cultivated. First crop of cucumber was planted in August and prolongs up to November. Second crop was planted in December and prolongs up to March. However, third crop of cucumber was planted in April and prolongs up to June. Hiltan and Multistar varieties of cucumber were grown by

the respondents.

## RESULTS AND DISCUSSION

### Tomato-Cucumber Rotation (R<sub>1</sub>)

The findings contained in Table 1 regarding the economics of tomato-cucumber (R<sub>1</sub>) rotation in polyhouse. It was found that only nine respondents adopted the same crop rotation pattern out of 40. Present study concluded that total cost of tomato production was ₹345386.83 while variable cost was ₹114631.9 per acre. Among various component of variable cost, harvesting was highest ₹42944.44 (12.43 per cent) followed by seed, plant protection, fertilizer and manures, ridging/bed preparation, field preparation, irrigation and weed control charges with ₹26377.78 (7.64 per cent), ₹13694.44 (3.97 per cent), ₹9455.83 (2.74 per cent), ₹6055.55 (1.75 per cent), ₹5166.66 (1.50 per cent), ₹861.11 (0.25 per cent) and ₹611.11 (0.18 per cent), respectively. Depreciation and interest on fixed capital investment contribute to 35.21 per cent of the total cost. Kumar *et al.* (2016) revealed that the depreciation and interest on fixed capital was maximum share in total cost.

In this rotation, data further indicated that the farmers spent ₹155055.5 on variable cost on cucumber production under polyhouse. The total cost on cucumber production was ₹262333.51 per acre. The cost structure of the total

**Table 1: Economics of tomato-cucumber rotation (R<sub>1</sub>)**

Particulars	Tomato		Cucumber		Total	
	Amount	Per cent	Amount	Per cent	Amount	Per cent
Field preparation	5166.66	1.500	5805.55	2.21	10972.22	1.81
Ridging/bed preparation	6055.55	1.750	6222.22	2.37	12277.77	2.02
Seed	26377.78	7.640	66177.78	25.23	92555.56	15.23
Fertilizer and FYM	9455.83	2.740	11252.78	4.29	20708.61	3.41
Irrigation	861.11	0.250	916.66	0.35	1777.77	0.29
Plant protection	13694.44	3.970	12111.11	4.62	25805.55	4.25
Weed control	611.11	0.180	5155.55	1.97	5766.66	0.95
Harvesting	42944.44	12.43	34611.11	13.19	77555.55	12.76
Variable cost (1 to 8)	105166.92	30.44	142252.80	54.23	247419.69	40.71
Interest on working capital	9465.020	2.740	12802.75	4.88	22267.77	3.66
Total variable cost (9+10)	114631.94	33.19	155055.50	59.10	269687.46	44.38
Management charge (10 per cent)	11463.19	3.32	15505.55	5.91	26968.74	4.44
Risk Factor (10 per cent)	11463.19	3.32	15505.55	5.91	26968.74	4.44
Marketing cost	17361.11	5.03	12777.78	4.87	30138.89	4.96
Depreciation and interest on fixed capital	160467.39	46.46	53489.13	20.39	213956.52	35.21
Rental value of land	30000.00	8.69	10000.00	3.81	39999.00	6.580
Total cost (11 to 16)	345386.83	100.00	262333.51	100.00	607720.36	100.00
<b>Return structure</b>						
Production (quintal)	341.66		395.83		737.49	
Gross return	530000.00		369444.40		899444.40	
Return over variable cost	415368.10		214388.90		629756.90	
Net return	184613.16		107110.89		291724.03	

variable cost shows that the highest proportion was spent on seed with ₹66177.78 (25.23 per cent) followed by harvesting, plant protection, fertilizer and manures, ridging/bed preparation, field preparation, weed control and irrigation charges with ₹34611.11 (13.19 per cent), ₹12111.11 (4.62 per cent), ₹11252.78 (4.29 per cent), ₹6222.22 (2.37 per cent), ₹5805.55 (2.21 per cent), ₹5155.55 (1.97 per cent) and ₹916.66 (0.35 per cent), respectively. In polyhouse cultivation of R<sub>1</sub> rotation, the result concluded that ₹269687/acre was variable cost. However, total cost of R<sub>1</sub> rotation was ₹607720.36 per acre. The cost structure of the total variable cost shows that the highest proportion was spent on seed with ₹92555.56 (15.23 per cent) followed by harvesting, plant protection, fertilizer and FYM, ridging/bed preparation, field preparation, weed control and irrigation charges with ₹77555.55 (12.76 per cent), ₹25805.55 (4.25 per cent), ₹20708.61 (3.41 per cent), ₹12277.77 (2.02 per cent), ₹10972.22 (1.81 per cent), ₹5766.66 (0.95 per cent) and ₹1777.77 (0.29 per cent), respectively.

The finding of the study mentioned in Table 1 indicates that the total cost incurred on tomato and cucumber cultivation was worked out to be ₹345386.83 and ₹262333.51 per acre respectively. It is also clear from Table 1 that the highest proportion in total cost was incurred as depreciation and interest on fixed capital in both the crops. The share of rental value of land in cost of cultivation of tomato was worked out to be 8.69 per cent. In cost of cultivation of cucumber, the proportion of management and risk factor, each was worked out to be 5.9 per cent of total cost respectively. The study revealed that the total cost of production of R<sub>1</sub> rotation was worked out ₹607720.36 per acre. In this cost the proportion of variable cost is ₹269687.46 (44.38 per cent) followed by cost incurred on depreciation and interest on fixed capital, ₹213956.52 (35.21 per cent), it shows that the fixed investment play a vital role in cost of production. The data pertaining to returns from R<sub>1</sub> rotation also depicted in Table 1. The results revealed that in the case of tomato production, average gross return per acre was estimated ₹530000. Return over variable cost and net returns worked out to be ₹415368.1 and ₹184613.16 respectively. Similarly, average gross returns received from cucumber cultivation were ₹369444.4. Return over variable cost and net returns were ₹214388.9 and ₹107110.89 respectively. The gross returns from R<sub>1</sub> rotation were estimated ₹899444.4 per acre per annum. While return over variable and net returns per acre per annum was worked out to be ₹629756.9 and ₹291724.03 respectively.

#### **Capsicum-Cucumber rotation (R<sub>2</sub>)**

The results pertaining the economics of capsicum-cucumber rotation under polyhouse in Table 2. It was found that only 15 respondents adopted the capsicum-cucumber rotation pattern out of 40. The result indicated that the capsicum growers spent ₹101667.91 as variable

cost. The total cost of capsicum production was worked out to be ₹326561.48 per acre. Among various component of variable cost, highest proportion was spent on harvesting ₹36100 (11.05 per cent) followed by seed, weed control, fertilizer and manures, ridging/bed preparation, field preparation, plant protection and irrigation charges with ₹17414.81 (5.33 per cent), ₹12648.15 (3.87 per cent), ₹10328.89 (3.16 per cent), ₹5611.11 (1.72 per cent), ₹5462.96 (1.67 per cent), ₹4796.29 (1.47 per cent) and ₹911.11 (0.27 per cent), respectively. Depreciation and interest on fixed capital investment contribute to 36.77 per cent of the total cost.

In R<sub>2</sub> rotation, data further indicates that the farmers spent ₹149851.2 on variable cost on cucumber production under polyhouse and the total cost on cucumber production were estimated ₹255255.01. The cost structure of total variable cost shows that the highest proportion was spent on seed with ₹63102.96 (24.72 per cent) followed by harvesting, plant protection, fertilizer and manures, ridging/bed preparation, weed control and field preparation with ₹35203.7 (13.79 per cent), ₹11166.67 (4.37 per cent), ₹10601.11 (4.15 per cent), ₹6314.81 (2.47 per cent), ₹5296.29 (2.07 per cent) and ₹4914.81 (1.93 per cent), respectively. On the other hand it was lowest in the case of irrigation charges (₹877.77, 0.34 per cent).

In polyhouse cultivation of R<sub>2</sub> rotation, the result indicates that the farmer incurred ₹251519.06/acre as variable cost. However, the total cost incurred on this rotation was worked out ₹581816.43. The cost structure of the total variable cost shows that the highest proportion was incurred on seed with ₹80517.77 (13.84 per cent) followed by harvesting with ₹71303.7 (12.26 per cent). Fertilizer and manures followed by weed control, plant protection, ridging/bed preparation, field preparation, and irrigation charges ₹20930 (3.60 per cent), ₹17944.44 (3.08 per cent), ₹15962.96 (2.74 per cent), ₹11925.92 (2.05 per cent), ₹10377.77 (1.78 per cent) and ₹1788.88 (0.31 per cent), respectively.

The result of the study mentioned in Table 2 indicates that the total cost incurred on capsicum and cucumber cultivation was ₹326561.48 and ₹255255.01 per acre, respectively. It is also cleared from Table 2 that the highest proportion in total cost was incurred on depreciation and interest on fixed capital in both the crops. The share proportion incurred on rental value of land in cost of cultivation of capsicum was 9.17 per cent. In cost of cultivation of cucumber, the proportion of management and risk factor was 5.87 per cent in each. The study also revealed that the total cost of production of this crop rotation was worked out to be ₹581816.43 per acre per annum and proportion of variable cost was ₹251519.06 (43.22 per cent) followed by cost incurred on depreciation and interest on fixed capital, ₹213956.52 (36.77 per cent). Thus, present study concluded that fixed investment play a very important role in cost of production.

Table 2: Economics of cucumber-cucumber-cucumberrotation (R<sub>2</sub>)

Particulars	(₹ /acre)					
	Capsicum		Cucumber		Total	
	Amount	Per cent	Amount	Per cent	Amount	Per cent
<b>Cost structure</b>						
Field preparation	6200.15	2.19	6305.05	2.22	6322.39	2.23
Ridging/bed preparation	7525.72	2.66	7550.72	2.66	7578.73	2.67
Seed	66951.73	23.70	66951.73	23.60	66951.73	23.60
Fertilizer and FYM	10752.07	3.81	10752.07	3.79	10752.07	3.79
Irrigation	1160.41	0.41	1182.41	0.42	1174.42	0.41
Plant protection	10137.93	3.59	10137.93	3.57	10137.93	3.57
Weed control	2800.79	0.99	2825.79	1.00	2814.79	0.99
Harvesting	32596.55	11.54	32996.55	11.63	33096.56	11.67
Subtotal (1 to 8)	138125.35	48.89	138702.3	48.89	138828.62	48.94
Interest on working capital	12431.28	4.40	12483.2	4.40	12494.575	4.40
Variable cost (9+10)	150556.63	53.29	151185.5	53.29	151323.19	53.35
Management charge (10 per cent)	15055.66	5.32	15118.55	5.33	15132.31	5.33
Risk Factor (10 per cent)	15055.66	5.32	15118.55	5.33	15132.31	5.33
Marketing cost	17213.79	6.09	17613.79	6.21	17413.8	6.14
Depreciation and interest on fixed capital	71318.84	25.24	71318.84	25.14	71318.84	25.14
Rental value of land	13333.33	4.72	13333.33	4.70	13333.33	4.70
Total cost (11 to 16)	282533.91	100	283688.56	100	283653.79	100
<b>Return structure</b>						
Production	440.17		444.07		450.24	
Gross return	418500		418856		418678	
Return over variable cost	267943.4		267670.5		267354.8	
Net return	135966.08		135167.44		135024.20	

The data pertaining to returns from R<sub>2</sub> crop rotation also depicted in Table 2. The results revealed that in the case of capsicum production gross return per acre was estimated ₹507986.1. Kumar *et al.* (2016b) reported that net return was higher in capsicum. Return over variable cost and net return were calculated ₹406318.2 and ₹181424.61 respectively. Similarly, gross returns from cucumber cultivation were ₹369444.4. However, return over variable cost and net returns was ₹219593.2 and ₹114189.39, respectively. The gross return from R<sub>2</sub> crop rotation was estimated ₹877430.5/acre per annum. While return over variable and net returns per acre was worked out to be ₹625911.4 and ₹295614.06 respectively.

**Cucumber-Cucumber-Cucumber rotation (R<sub>3</sub>)**

The findings pertaining to the economics of cucumber-cucumber-cucumber rotation under polyhouse in Table 3. Out of 40 respondents only 16 respondents adopted the same crop rotation pattern. The results indicated that variable cost per annum of the farmers was ₹453065.3. While the total cost on cucumber production was ₹849876.2 per acre per annum. Among various component of variable cost, highest proportion was spent on seed ₹200855.19 (23.63per cent) followed

by harvesting and fertilizer and manures, ₹98689.66 (11.61per cent) and ₹32256.21(3.80per cent). Plant protection, ridging/bed preparation, field preparation, weed control, and irrigation charges was ₹30413.79 (3.58per cent), ₹22655.17 (2.67 per cent), ₹18827.59 (2.22per cent), ₹8441.37 (0.99per cent) and ₹3517.24 (0.41per cent), respectively. Depreciation and interest on fixed capital investment contribute to 25.18 per cent of the total cost in cucumber crop production.

The result of the study mentioned in Table 3 indicates that the total cost incurred on this cropping rotation was ₹849876.2 per acre per annum. Presented study also shows that the highest proportion in total cost was incurred on depreciation and interest on fixed capital. The share incurred on rental value of land in cost of cultivation of R<sub>3</sub> cropping rotation was 4.71 per cent and proportion of management and risk factor, each was 5.3 per cent respectively. While proportion of variable cost was ₹453065.3 (53.31 per cent) followed by cost incurred on depreciation and interest on fixed capital, ₹213956.5 (25.18 per cent). Results showed that the fixed investment constitutes a major component of total cost. The gross returns per annum from R<sub>3</sub> crop rotation was estimated

Table 3: Economics of capsicum-cucumber rotation (R<sub>2</sub>)

Particulars	Capsicum		Cucumber		Total	
	Amount	Per cent	Amount	Per cent	Amount	Per cent
<b>Cost structure</b>						
Field preparation	5462.96	1.67	4914.81	1.93	10377.77	1.78
Ridging/bed preparation	5611.11	1.72	6314.81	2.47	11925.92	2.05
Seed	17414.81	5.33	63102.96	24.72	80517.77	13.84
Fertilizer and FYM	10328.89	3.16	10601.11	4.15	20930	3.60
Irrigation	911.11	0.27	877.77	0.34	1788.88	0.31
Plant protection	4796.29	1.47	11166.67	4.37	15962.96	2.74
Weed control	12648.15	3.87	5296.29	2.07	17944.44	3.08
Harvesting	36100	11.05	35203.7	13.79	71303.7	12.26
Subtotal (1 to 8)	93273.32	28.56	137478.1	53.86	230751.44	39.66
Interest on working capital	8394.59	2.57	12373.03	4.85	20767.62	3.57
Variable cost (9+10)	101667.91	31.13	149851.2	58.70	251519.06	43.22
Management charge (10per cent)	10166.79	3.11	14985.12	5.87	25151.90	4.32
Risk Factor (10per cent)	10166.79	3.11	14985.12	5.87	25151.90	4.32
Marketing cost	14092.59	4.32	11944.44	4.68	26037.03	4.48
Depreciation and interest on fixed capital	160467.39	49.14	53489.13	20.96	213956.52	36.77
Rental value of land	30000	9.17	10000	3.92	40000	6.88
Total cost (11 to 16)	326561.48	100	255255.01	100	581816.43	100
<b>Return structure</b>						
Production	356.48		391.66		748.14	
Gross return	507986.1		369444.4		877430.5	
Return over variable cost	406318.2		219593.2		625911.4	
Net return	181424.61		114189.39		295614.06	

₹1256034 per acre. While return over variable and net returns per acre was ₹802968.7 and ₹406157.8 per acre per annum, respectively. Nair & Barche (2014) also concluded that protected cultivation of vegetable offers distinct advantage of quality, productivity and favourable market price to the growers.

#### Comparative economics of different vegetable crop rotations

The information regarding the composition and the total expenditure on per acre basis of different vegetables rotations under polyhouse is incorporated in Table 4. This would enable us to know which of the crop rotation need more investment and which crop rotation is more beneficial. The result revealed that the R<sub>3</sub> crop rotation was most expensive because of its highest expenditure of ₹849876.2 per acre followed by R<sub>1</sub> (₹607720.36), while R<sub>2</sub> was least expensive crop rotation with expenditure of ₹581816.43 per acre. The results indicated that gross return was highest from R<sub>3</sub> with ₹1256034 per acre followed by R<sub>1</sub> and R<sub>2</sub> with ₹899444.4 and ₹877430.5, respectively. In the case of net return, it was highest in R<sub>3</sub> (₹406157.8) followed by R<sub>2</sub> and R<sub>1</sub> with ₹295614.06 and ₹291724.03, respectively. Singh & Sirohi (2006) also concluded that vegetable growers can substantially increase their income by protected

Table 4: Comparative economics of different vegetable crop rotations

Cost and Return	₹/acre		
	R <sub>1</sub>	R <sub>2</sub>	R <sub>3</sub>
Variable cost	247419.69	251519.06	453065.3
Total cost	607720.36	581816.43	849876.2
Production (quintal)	737.49	748.14	1334.48
Gross return	899444.4	877430.5	1256034
Return over variable cost	629756.9	625911.4	802968.7
Net return	291724.03	295614.06	406157.8

cultivation of vegetables in off-season.

#### CONCLUSIONS

Present study concluded that cucumber-cucumber-cucumber rotation (R<sub>3</sub>) was most expensive and gross return was also highest from this crop rotation. It means cucumber-cucumber-cucumber rotation (R<sub>3</sub>) helps the farmers to increase the net return around double as compared to another rotation. The present study also shows that the highest proportion in total cost was incurred on depreciation and interest on fixed capital in all rotations. Results in the present study show that the fixed investment constitutes a major component of total cost. The highest production of vegetables (1334.48 quintal per acre) was obtained from the cucumber-cucumber-

cucumber rotation ( $R_3$ ). The productivity of cucumber in cucumber-cucumber-cucumber rotation ( $R_3$ ) would be more than other rotations adopted by the respondents growing region.

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## Extent of Crop Diversification in Maharashtra

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### ABSTRACT

The area under cereal crops is dominated with decreasing trend in all the regions over the time. The increased trends were observed in the magnitudes of diversification indices during post- WTO period over Pre-WTO period. It implies that the cropping pattern as a whole has been diversified but among the group of crops, the acreage under foodgrains and commercial crops has been increased. The diversification of crops found in western Maharashtra, stagnant in Marathwada and Vidarbha regions and decline in diversification indices in Konkan region. This suggests that major emphasis given on irrigation and infrastructure development in Marathwada, Vidarbha and Konkan regions of Maharashtra.

### Keywords

Area, crop diversification, major crops, Herfindahl index

### JEL Codes

O21, P17, Q01, Q18

### INTRODUCTION

The agricultural production is very sensitive to rainfall, prices, government policies and technological factors. Flood, cyclone and drought are the major threats to agricultural production. Agricultural production deviates due to lack of stability providing factors like irrigation, flood control, control over prices and production. Since 1990, the Indian agriculture has experienced the significant changes with diversification from traditional food crops to commercial crops, plantation crops, and horticultural crops (Nadkarni, 1996; Joshi *et al.*, 2004). Diversification in cropping is possible and essential to save the crumbling agriculture economy and environment of the study area. Crop diversification acquires special significance in this region because of the ecological and environmental problems and strain on natural resources associated with the Green Revolution technology, and difficulty in sustaining growth in output and income.

The Maharashtra state comprises the Konkan, Western Maharashtra, Marathwada and Vidarbha regions which represent varying types of natural, physical, social, and economic conditions quite distinct from each other. The variability in topography, soil and climatic factors bear significant impact on crop and land use pattern. The gross

cropped area of the State increased from 188.23 to 231.06 lakh hectares during last fifty five years while the gross irrigated area increased from 12.20 lakh hectares to 49.26 (303 per cent) lakh hectares. The farmers all over the Maharashtra try to grow several crops in their holdings in an agricultural year. The level of crop diversification largely depends on the geo-climatic/socio-economic conditions and technological development in a region. It is generally considered that higher the level of agricultural technology, the lesser the degree of diversification. Moreover, rich farmers prefer to specialize in agricultural enterprise while the poor and subsistent farmers are generally more interested in diversification of crops.

In view an attempt was made to examine the extent of crop diversification across the regions of Maharashtra State at different points of time. The approach adopted in this study was to utilize indicator of crop diversification (Herfindahl index). This quantitative measure is mainly used for analyzing the functional relationship between degree of economic diversification, economic performance and economic stability. This help in understanding structural composition of an aggregate and to compare it over time and space, also used as indicator of safety and risk. In addition, they reveal allocation strategy

among activities of the different firms (Chand, 1996).

**METHODOLOGY**

The study is based on the time series data related to the area of major crops viz; Cereals (Paddy, Wheat, Kh. Jowar, R. Jowar, Bajra, Maize), Pulses (Tur, Mung, Udid, Gram), Oilseeds (Groundnut, Sunflower, Safflower, Sesamum, Soybean) and commercial crops (Sugarcane, Cotton and Onion) during 1975-76 to 2012-13. The data were collected from the publications of Government/Non-Governmental Organizations such as Epitome, District Statistical Abstracts, Agricultural statistics at a Glance, etc. The time span is further distributed into three periods, Period-I: 1975-76 to 1993-94, which is Pre-liberalization period, Period-II: 1994-95 to 2012-13, where the liberalization was introduced in the year 1995 and for estimating the effect of this liberalization on production and productivity of major crops and the Period III: Overall Period: 1975-76 to 2012-13. To assess the magnitude of crop diversification, The Herfindahl Index was used.

**Herfindahl Index (HI)**

$$Herfindahl\ Index\ (H_i) = 1 - \sum_{i=1}^N P_i^2$$

Where N is the total number of crops and Pi represents acreage proportion of the i<sup>th</sup> crop in total cropped area. It is a measure of concentration. For increasing diversification, HI is decreasing and vice-versa. It is bounded by 0 (complete diversification) and 1 (complete specialization)

**RESULTS AND DISCUSSION**

**Changes in Gross Cropped Area**

The area under different crop categories in different regions of Maharashtra state is depicted in Table 1.

Table 1 indicates that the Maharashtra's agricultural production is dominated by cereals and commercial crops to the tune of 36 and 29 per cent. Oilseeds occupied 20 per cent share and 15 per cent by pulses. On the whole, Maharashtra's agricultural production is foodgrain dominating.

The per cent changes in area under crop categories during different time periods in Maharashtra are presented in Table 2.

It is revealed from the table that, the area under cereal crops is dominated with decreasing trend in all the regions over the time of the state. The area under pulses is increased in Vidarbha region from 14.41 to 21.78 percent followed by Konkan (3.52 to 4.22 %). Vidarbha and Marathwada region have reported increase in percentage shares of area under oilseed crops, this may due to introduction of soybean crop and implementation TMO (Technology Mission on Oilseeds) programme in the state. Western Maharashtra (29.83) and Marathwada (32.33) have shown higher increase in percentage area shares of commercial crops.

**Changes in extent of Crop diversification**

The results of the diversification indices for four

Table 1: Area under different crop categories in Maharashtra

Periods	Period I 1975-76				Period II 1994-95				Period III 2012-13			
	Cereals	Pulses	Oilseeds	Commercial	Cereals	Pulses	Oilseeds	Commercial	Cereals	Pulses	Oilseeds	Commercial
KON	4251	149	29	9	4417	196	51	3	4135	147	47	4
WM	46907	6345	6889	4489	44504	7140	8098	7976	30300	5462	5968	17738
MAR	26080	8013	4861	5999	29154	11048	8371	9929	17990	10990	12140	19645
VID	24501	5549	2272	15340	20707	12463	6373	15867	12916	12616	17779	15405

Table 2: Change in Area under Crop Categories in Maharashtra

Periods	Period I 1975-76				Period II 1994-95				Period III 2012-13			
	Cereals	Pulses	Oilseeds	Commercial	Cereals	Pulses	Oilseeds	Commercial	Cereals	Pulses	Oilseeds	Commercial
KON	95.79	3.52	0.50	0.20	94.64	4.69	0.60	0.06	95.44	4.22	0.24	0.092
WM	72.57	17.42	3.05	6.94	65.72	15.94	6.56	11.78	50.95	12.86	6.36	29.83
MAR	58.02	22.14	6.50	13.35	49.83	20.49	12.70	16.97	29.61	18.49	19.57	32.33
VID	51.41	14.67	1.74	32.18	37.37	23.70	10.29	28.64	22.00	21.78	29.99	26.24

**Table 3: Herfindahl Index (HI) values of crop diversification in Maharashtra**

Periods	Time Period I				Time Period II				Time Period III			
	Kon	WM	Mar	Vid	Kon	WM	Mar	Vid	Kon	WM	Mar	Vid
All crops	0.201	0.853	0.883	0.816	0.291	0.855	0.889	0.857	0.272	0.879	0.862	0.818
Cereals	0.095	0.708	0.714	0.651	0.183	0.678	0.704	0.681	0.094	0.681	0.687	0.594
Pulses	0.662	0.743	0.793	0.774	0.692	0.774	0.763	0.757	0.591	0.725	0.695	0.683
Oilseeds	0.000	0.437	0.552	0.519	0.000	0.712	0.672	0.570	0.000	0.596	0.352	0.520
Commercial crops	0.433	0.571	0.169	0.013	0.000	0.578	0.223	0.028	0.000	0.609	0.226	0.031

*Kon-Konkan, WM- Western Maharashtra, Mar-Marathwada, Vid-Vidarbha*

regions during different periods are presented in Table 3.

It is observed from the table that, the cropping pattern of Konkan region was more diversified during period 1994-97 than 1975-78 as the magnitudes of Herfindahl Index 0.29 and 0.20, respectively. Among the various crop groups, the magnitude of Herfindahl Index for cereals was only 0.09 and shows no variations and pulses decreased to 0.59 during 2010-13. This has happened in the group, because more and more land was brought under paddy cultivation during latter periods. The perfect diversification was noticed for pulses and sugarcane in all periods under study.

In Western Maharashtra region the magnitudes of Herfindahl Index increased for all crops, cereals, pulses, oilseeds and commercial crops over the period under study. This is the indication of considerable diversification which has occurred in these crop groups. The maximum diversification has noticed in case of oilseeds (0.43 to 0.59) followed by commercial crops (0.57 to 0.60). The values of H.I. for cereals decreased over the period mainly because the rabijowar crop occupied more than 48 per cent area in the total cereals crops during 2012-13 which was 40 per cent during 1975-76.

In Marathwada region magnitudes of Herfindahl Index for all crops were 0.88, 0.88, and 0.86 for periods 1975-78, 1994-97 and 2010-13, respectively. This has clearly indicated that the cropping pattern of Marathwada region was considerably diversified during all periods under study.

The magnitude of H.I. for commercial crops was 0.16 during 1975-78 which increased to 0.22 and revealed the increased diversification among these crop groups. The less diversification was noticed in the cereals, pulses and oilseeds during 2010-13, as the magnitudes of H.I. for these crops were at lower side than the period 1975-78. This might be due to rabi jowar and tur has captured more share in total cereals and total pulses, whereas soybean has prominent area under oilseeds during 2010-13.

In Vidarbha region the values of H.I. for all crops, oilseeds, and commercial crops have increased whereas the values for cereals and pulses were decreased over the periods under study. The magnitudes of H.I. were 0.81, 0.51 and 0.01 for all crops, oilseeds, and commercial crops, respectively during 1975-78, which have increased

to 0.81, 0.52 and 0.03 during period 2010-13. Increased proportionate share of paddy (55.03 per cent) in total cereals, tur (42.48 per cent) and gram (31.78 per cent) in total pulses have brought down the magnitudes of H.I. of respective crop group in the region during 2010-13.

### CONCLUSIONS

The forgoing discussion concludes that the area under cereal crops is dominated with decreasing trend in all the regions over the time of the state. The increased trends were observed in the magnitudes of diversification indices during post-WTO period over Pre-WTO period. For all the crops together, the increased diversification was observed in Western Maharashtra whereas the magnitudes of diversification indices remained the same for Marathwada and Vidarbha regions, whereas decreased values of diversification were noticed in the case of Konkan region. Diversification indices of cereals and pulses for Konkan region, pulses, oilseeds and commercial crops for Western Maharashtra, oilseeds and commercial crops for Marathwada and cereals, oilseeds and commercial crops for Vidarbha have shown increasing diversification indices for post-WTO period. It implies that the cropping pattern as a whole has been diversified but among the group of crops, the acreage under foodgrains and commercial crops has been increased.

### POLICY OPTIONS

The diversification of crops found in western Maharashtra, stagnant in Marathwada and Vidarbha regions and decline in diversification indices in Konkan region. This suggests that major emphasis given on irrigation and infrastructure development in Marathwada, Vidarbha and Konkan regions of Maharashtra.

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## **Impact Assessment of Chickpea (*Chana*) Price Forecast Advice on Economic Status of the Farmers**

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### **ABSTRACT**

*The study was commenced to investigate and apprehension the impact of pre sowing price forecast of Chickpea released during September, 2015. Monthly time series data on average prices of Chickpea for the period from 2006 to 2015 were collected from APMC, Bikaner. ARIMA (1,1,1) was used and forecasted prices were calculated. Finally an advisory was disseminated through different mechanisms. The impact assessment of price forecast was done on 20 adopter farmers of Bikaner. Thus, a significant acreage increase and an incremental income realized to the extent of ₹17001.6 per hectare by the farmers.*

### **Keywords**

Agricultural produce market committee, chickpea, decision making, impact assessment, price forecasting

### **JEL Codes**

C52, C53, Q12, Q13, Q15, Q16, Q18

### **INTRODUCTION**

The Indian agriculture is undergoing a lot of transformations such as growing commercialization and diversification towards high value agricultural commodities, increasing liberalization and global interfaces, increase in foreign direct investment etc. Several institutional and policy initiatives have been taken to support these transformations. However, prices of agricultural commodities play a dominant role in farm profitability and distribution of income. A remunerative and stable price environment is considered to be very important for providing incentives to farmers for increasing agricultural production and productivity (Chand & Parappurathu, 2012). In recent years, the agricultural prices have suffered from very high volatility. The issue of high price volatility in agricultural commodities in domestic as well as international market has assumed critical importance in the changing context of trade liberalisation. The volatility in the agricultural prices has catastrophic effect on all stakeholders involved in the production,

marketing and consumption of the food commodities. This has increased the risk faced by farming community. Thus, proper understanding of agricultural price mechanism and their forecast would help farmers to plan and decide about the production portfolio and their marketing for improved farm profit, consumers to plan their budget, traders to know the market trend and Government to augment economic development in the nation. The sufficient information about the prices would strengthen the otherwise weak linkage between production and marketing in the country. However, the precondition of the benefits of price forecast is that it should be based on efficient market intelligence. Therefore, it is important that logical and reliable price forecasts for agricultural commodities are developed using scientific analysis to allow producers to make better-informed decisions and manage price risk. The present study will generate price forecasts for major agricultural commodities in different parts of the country. The price forecasts will be disseminated to the farmers before sowing and during harvests so that

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informed and intelligent decisions can be taken by the farmers. This will also help in strengthening the marketing infrastructure and support marketing decisions of the stakeholders. The regional studies in the project will help in understanding the price movements, linkages between marketing infrastructure and price behaviour, impact on farmers' decision making etc. ICAR-National Institute of Agricultural Economics and Policy Research (NIAP), which is an apex body of agricultural economics in the country, will lead the project with the help of its consulting and consortium partners in different parts of the country. Since the centre is playing the guiding role for agricultural policies at the national level, this project will be very crucial in determination and formation of agricultural marketing policies in the country.

Chickpea is the world's second-largest cultivated food legume. It is currently grown on over 11 million hectares in the Mediterranean, western Asia, South Asia, Australia and Sub-Saharan Africa, especially in Eastern and Southern Africa. World Chickpea production is well over 9 million tonnes and 96 per cent cultivation is in developing countries. India is the world's largest producer and consumer of Chickpea, accounting for over 66 per cent of world production. Other major producers are Pakistan, Turkey, Iran, Myanmar, and Canada. Ethiopia and Kenya are the leading producers in Sub-Saharan Africa. Chickpea is a dry-season legume that grows well on the residual moisture of the post-rainy season, providing a unique opportunity of enhancing legume production in developing countries as it does not compete for area with other major legumes. Indeed, this feature gives farmers a second crop (where only one crop would traditionally be grown), hence increased income and better nutrition. Chickpea is most important pulse crop of India in terms of both area and production. India is the largest producer of Chickpea in the world. In India, Chickpea cultivation was done on 6.71 million hectares with the production of 5.47 million tonnes of the grain yield during 2004-05. During 2013-14, Chickpea production reached to record 9.53 million tonnes (Table 1). Table 2 shows trend in area and production of Chickpea in Rajasthan for last ten years. There are wide fluctuation in its area and production in the recent years. In the year 2009-10, the area and production has fallen down up to 8.84 (lakh ha) and 5.34 (lakh tonnes), respectively. However, in the year 2010-11, there is sudden increase in its area and production due to good cropping season. The year 2011-12 was not favourable for Chickpea production due to poor rainfall during crop season and long dry spell. Again in the year 2013-14 area and production increased.

#### **Statement of the Problem**

The Network Project on Market Intelligence is functioning in the Department of Agricultural Economics, College of Agriculture, Swami Keshwan and Rajasthan Agricultural University, Bikaner. The main

**Table 1: All India area, production and yield of Chickpea**

Year	Area (million ha)	Production (million tonnes)	Yield (kg/ha)
2004-05	6.71	5.47	815
2005-06	6.93	5.60	808
2006-07	7.49	6.33	845
2007-08	7.54	5.75	762
2008-09	7.89	7.06	895
2009-10	8.17	7.48	915
2010-11	9.21	8.22	896
2011-12	8.32	7.70	912
2012-13	8.52	8.83	1036
2013-14	9.93	9.53	960

*Source: Directorate of Economics & Statistics, Krishi Bhawan, New Delhi, [http://www.iipr.res.in/pdf/2.1\\_270615.pdf](http://www.iipr.res.in/pdf/2.1_270615.pdf) as accessed on Jan 3, 2016*

**Table 2: Area, production and yield of Chickpea in Rajasthan**

Year	Area (000'ha)	Production (000' tonnes)	Yield (kg/ha)
2004-05	1035.2	773.0	747
2005-06	1081.9	478.9	443
2006-07	1010.8	872.6	863
2007-08	1231.3	574.2	466
2008-09	1259.5	981.2	779
2009-10	884.4	534.6	605
2010-11	1783.0	1601.0	898
2011-12	1433.9	991.1	691
2012-13	1252.9	1277.4	1019
2013-14	1923.5	1640.4	853

*Source: Directorate of Economics & Statistics, Krishi Bhawan, New Delhi, [http://www.iipr.res.in/pdf/2.1\\_270615.pdf](http://www.iipr.res.in/pdf/2.1_270615.pdf) as accessed on Jan 3, 2016*

objectives of the project are to provide short term price forecast information to the farmers well in advance before sowing so that they will take appropriate sowing and input utilization decisions and before harvesting so that they will take better selling and storage decisions, besides this to conduct regional case studies on price movements, marketing infrastructure and farmers' decision making. NPMI, unit of SKRAU, Bikaner made the pre-sowing price forecast of Chickpea (Chana) for the production year 2015-16. According to the price forecast released on September 2015, the average farm gate price of Chickpea (Chana) during the month from February-June, 2016 was estimated to ₹4540-4700/quintal and advice was given that higher prices could be received during May to June. Based on the above price levels, farmers were recommended to increase area of crop, store and sell from May to June.

#### **MATERIALS AND METHODS**

Data related to price of chana in Bikaner Mandi of Rajasthan from Jan 2006 to Dec 2015 were collected from

Agmarknet. ARIMA modelling, introduced by Box and Jenkins, has been used to forecast pre sowing price (Burark *et al.*, 2011; Chandran & Panday, 2007; Paul *et al.*, 2013). The set of models introduced by them are popularly known as ARIMA models. This technique is used to forecast future values of a series based on completely its own past values. The main application of this methodology is in the area of short term forecasting and it requires at least 50 data points using Uni variate statistics. This method is superior to other method when the data are reasonably for longer period and there is a stable correlation pattern among past observation.

In the impact assessment of price forecast, one village Benisar, Tehsil- Shri Dungargarh of Bikaner district (Smart Village Adoption Programme of SKRAU, Bikaner) during September, 2015 was purposively selected for the present impact study. One day training programme on awareness and use of market intelligence, about 20 farmers who adopted the advice were selected for the present impact study. The information required for the study was collected from the sample farmers through personal interview using a questionnaire. The primary data under investigation pertained to the Agricultural year 2015-16. Simple tabular analysis was carried out to arrive at the estimates. The farmers were asked to specify the actual quantity of Chickpea (Chana) that was retained and

carried over from March to June, 2016 in anticipation of better prices after coming to know the price forecasting information released by this centre. Only this retained quantity was taken into consideration to quantify the impact of the price forecast. The incremental value of this quantity was worked out from the actual prices for the month of March, 2016.

### RESULTS AND DISCUSSION

The results obtained from the study as well as relevant discussion have been summarized under the following heads:

#### Forecasting of Chickpea (Chana) Price

The results of ARIMA model are presented in Figure 1. Figure 2 and Figure 3 showing that the series is not stationary in nature. So after converting series to stationary various ARIMA models were applied. The best fitted model i.e. ARIMA (1, 1, 1) was selected on the basis of lowest AIC (Akaike's Information Criterion) and SBC (Schwarz's Bayesian Criterion) value and test of significance. The results of ARIMA (1, 1, 1) model were found tune with the trader's survey, commodity futures, and export import scenario, production scenario of the nation and carryover stock. Finally a market advisory were prepared and released through different mass media like IFFCO Kisan Sanchar Limited (IKSL), SMS, Newspaper, Local media, Magazine, College website,

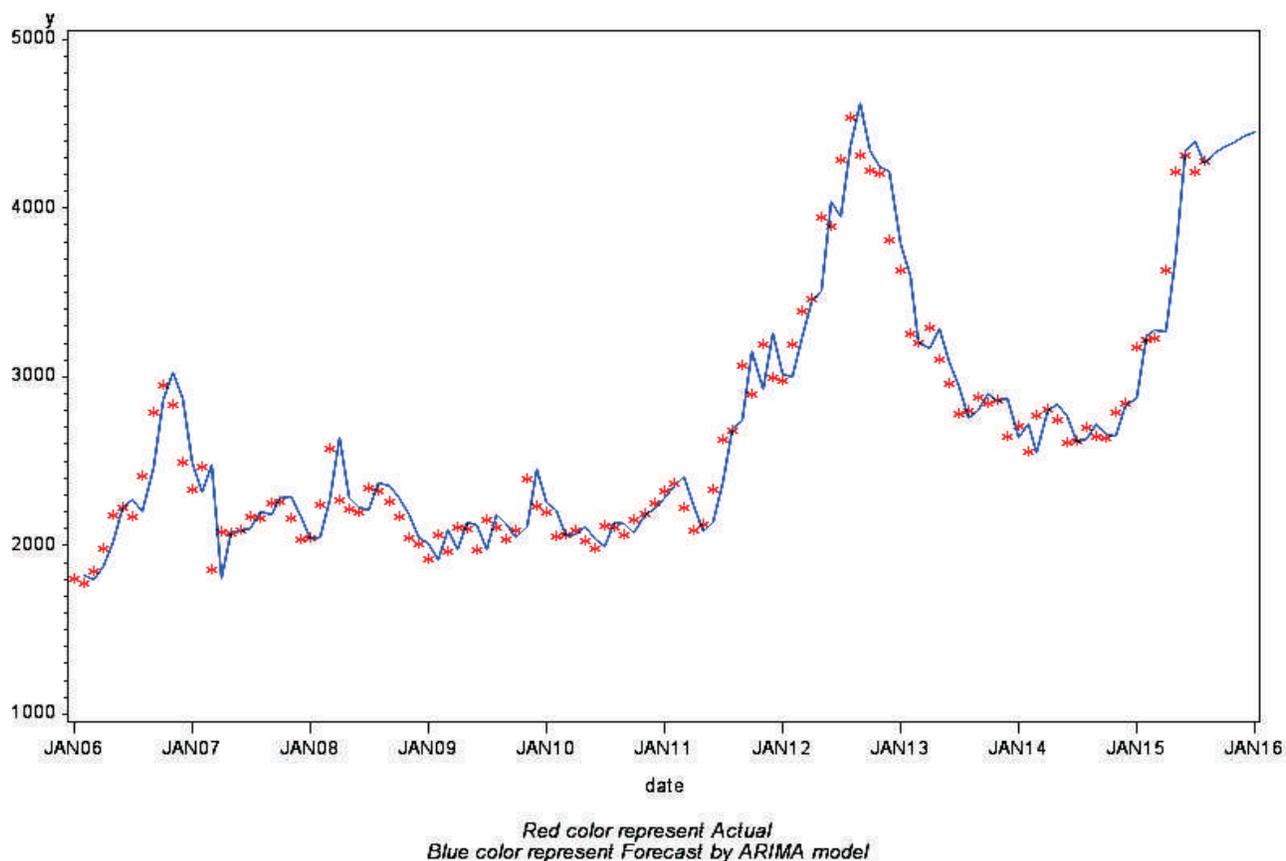


Figure 1: Actual and predicted price of Chickpea

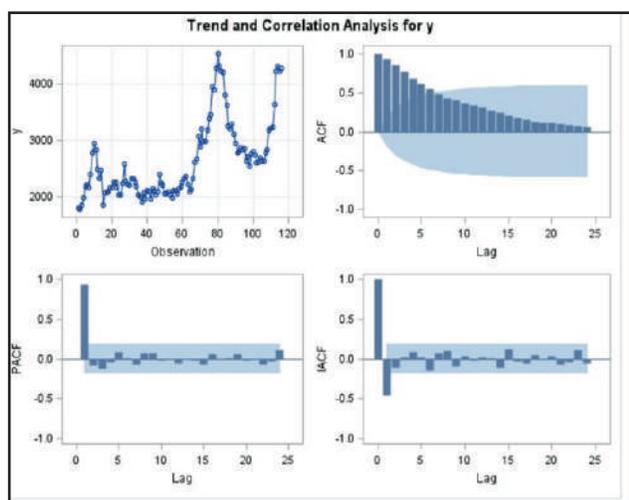


Figure 2: Results showing Non-Stationarity of the data (without differencing)

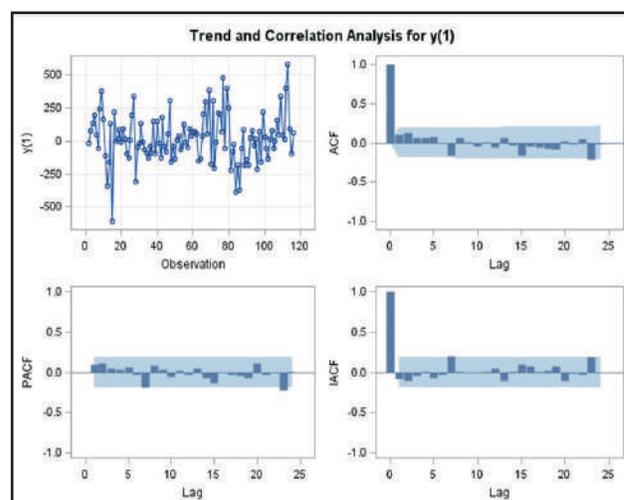


Figure 2: Results showing Non-Stationarity of the data (after applying differencing)

Table 3: Production and details of retention of Chickpea (Chana) by sample farmers

Particulars	Value (₹)
Average land holding under Chickpea (Chana), ha	1.68 ha
Total production during 2015-16 (q)	309.12
Average price per q received during the March 2016	4249
Average price per q received during the May-June 2016	₹ 6097
Marketed surplus (q) in the month of May-June 2016	309.12
Income realizable at the March 2016 prices	1313450.88
Income realized at the May-June 2016 prices	₹ 1884704.64
Total incremental income realized (per ha)	₹ 571253.76 or ₹17001.6

Source: Author's own computation, Primary Data 2016

KVK. The forecasted price was ₹4540-₹4700 per quintal in March 2016 to May 2016 in the Bikaner APMC of Rajasthan and advice was given that higher prices could be received during April to May. Based on the above price levels, farmers were recommended to store and sell from April to May.

#### Impact of the Price Forecast

The average operated holding size under Chickpea (Chana) of the sample farmers was 1.68 ha. The production and price related information pertaining to the selected farmers are presented in Table 3. The average prices during March, 2016 were ₹4249 per quintal. The situation during the Agricultural year 2015-16 changed drastically due to the supply constraints. As a result, the prices reacted sharply. Once the price forecast by the NPMI, unit, SKRAU, Bikaner indicated a possible hike in prices due to mismatch in the demand-supply position and, it may be noted that 309.12 quintals were retained by the sample farmers alone, in anticipating of higher prices after March, 2016. The incremental income realized was estimated at the May and June prices realization on this retained quantity. It amounts to ₹571253.76 and ₹ 17001.6

per hectare basis. Similar findings were also reported by Tingre *et al.* (2012).

#### CONCLUSIONS

Market information and intelligence are crucial to enable farmers and traders to make informed decisions about what to grow, when to harvest, to which markets produce should be sent to sell and whether to store it or not. India is the largest producer and consumer of Chickpeain the world. The study has revealed that the ARIMA model being stochastic in nature could be used successfully for modelling as well as for forecasting of monthly pricing of Chickpea in Bikaner APMC. The model has demonstrated a good performance in terms of predicting power. The forecasted price was ₹4540-4700/quintal in March 2016 to May 2016 in the Bikaner APMC of Rajasthan and advice was given that higher prices could be received during April to May. Based on the above price levels, farmers were recommended to store and sell from April to May.

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## Trends and Constraints of Onion Production in Haryana

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### ABSTRACT

The present study was conducted in Naraingarh and Bararablocks in Ambala district of Haryana. In Haryana area, production and productivity of onion shows positive trend with compound growth rate of 12.65, 14.27 and 1.35 per cent from the year 1992 to 2013. Major problems faced by the onion growers in production were costly storage facilities (95.55 per cent), lack of knowledge of recommended fertilizer doses (91.11 per cent) and high cost of seed (71.11 per cent). Problems faced in marketing of onion were accounted as lack of minimum support price (95.00 per cent), high fluctuations in market prices (78.89 per cent), malpractices adopted by market functionaries (67.78 per cent), and existence of large number of intermediaries in marketing process (60.00 per cent) and high transportation cost (58.89 per cent).

### Keywords

Compound growth rate, constraints trend, production, productivity

### JEL Codes

M31, Q11, Q13

### INTRODUCTION

Onion (*Allium cepa L.*) is a major bulbous crop among the cultivated vegetable crops and it has global importance. India has varying climatic conditions and provides an opportunity for growing a large number of horticultural crops including vegetables. The onion is an important vegetable and has been grown in almost all the part of India for thousands of years. The onion is regarded as a highly export orientated crop and earn valuable foreign exchange for the country, though India produce a significant quantity of onion it is not regular and sufficient to met the demands for both domestic requirement and exports (Kulkarni *et al.* 2012). India rank second in global onion production after China and with annual production of 17 to 18 million tonnes accounts for around for 20 per cent of global production as reported by National Horticultural Research and Development Foundation, 2015. However, Indian onion yield is one of the lowest. The inherent lower productivity in sub-tropical countries vis-a-vis European countries. Shortage and high price of quality seeds, high incidence of pest and diseases typical under tropical conditions, moisture stress or excess rains during critical growth stages are factors constraining

yield. Wide price fluctuations make it a risky crop discouraging large scale adoption of input intensive production techniques and good management practices by farmers.

During the year 2014-15, India occupies an area of 1173.36 thousand ha, with production of 18928.39 thousand tonnes. Maximum onion production takes place in Maharashtra (5361.91 thousand tonnes) followed by Karnataka (3227.04 thousand tonnes), Madhya Pradesh (2842.00 thousand tonnes), Bihar (1247.31 thousand tonnes), Gujarat (1126.55 thousand tonnes), Rajasthan (960.78 thousand tonnes) Haryana (640.22 thousand tonnes), Andhra Pradesh (575.58 thousand tonnes) and Telangana (450.54 thousand tonnes), respectively (National Horticultural Research and Development Foundation).

The area, production and productivity of onion in Haryana were 28.69 thousand hectare, 640.22 thousand tonnes and 22.32 tonnes per hectare respectively during the year 2014-15. In India, Haryana's share in onion production was 3.38 per cent during the year 2014-15 (National Horticultural Research and Development Foundation). In Haryana, onion has got a prominent place

and holds the second position among the other vegetable crops after potato with respect to area under different vegetables. In Haryana, it is grown mainly in the districts like Ambala, Karnal, Kurukshetra, Panipat, Sonapat, Mewat, Rewari and Yamunanagar.

Profitability of onion crop not only depends upon efficient marketing but also on the modern farming practices. The various marketing intermediaries such as trader, wholesaler-cum-commission agent and retailer are involved in marketing channel of onion. Its price varies greatly from season to season because of its semi-perishable nature and immediate post-harvest sales by the growers due to financial obligation, lack of storage facilities, spoilage and other expenses incurred during storage, seasonal glut which leads the distress sales of onion. The fluctuation in prices are generated by speculative activities of intermediaries, sharp increase in the price after the bulk of produce has moved up into the whole sale market channels serving neither the interests of the producers of the ultimate consumers.

**MATERIAL AND METHODS**

**Selection of Study Area**

**Selection of District:** The present study was conducted in Ambala district of Haryana state having the highest area under onion cultivation, which was purposively selected for to study constraints faced by farmers in production, marketing of onion during 2014-15 and trends in area, production and productivity of onion in Haryana during 2012-13. Both primary as well as secondary data have been used for attaining the objectives.

**Selection of blocks:** From the selected district, Barara and Naraingarh blocks having the largest area under the onion cultivation were selected for the study.

**Selection of villages:** A list of all the onion growing villages of Barara and Naraingarh blocks in Ambala district were obtained from District Horticulture Development Office. Three villages were selected from each block having highest area under onion cultivation. These villages were Serdheri, Binjalpur and Sohana in Barara block and Gajipur, Mirpur and Raiwali from Naraingarh block in Ambala district.

**Table 1: Selection of district, blocks and villages in Ambala district of Haryana**

Particulars	Selection of study area	
District	Ambala	
Blocks	Barara	Naraingarh
Villages	Sardheri, Binjalpur, Sohana	Gajipur, Mirpur, Raiwali

**Selection of farmers:** From these selected villages, a list of all the onion growers was prepared ultimately, 15 farmers from each selected villages were taken. In all, 90 farmers were selected to study constraints faced by farmers in production, marketing of onion during 2014-15.

**Collection of Data:** Both primary as well as secondary data were used for attaining the objective of the study undertaken. For studying the trends in area, production and productivity of onion in Haryana during 2012-13 secondary data were collected and to study constraints faced by farmers in production, marketing of onion during 2014-15 from the selected respondents by conducting personal interviews on a specifically designed pretested schedule.

**Analytical techniques:** To fulfill the specific objective of the study, the data collected were subjected to statistical analysis. For this purpose the following statistical techniques were adopted.

**Trends and growth rates in area, production and productivity**

For studying the compound growth rates (C. G. R.) in area, production, and productivity of onion for the Haryana were calculated for the period of 20 years i.e. 1992-93 to 2012-13. The compound growth rates were computed using the exponential function of the form:

$$X_t = a b^t u_t$$

$$\text{Log } X_t = \text{Log } a + t \text{Log } b + \text{Log } u_t$$

Where,

$X_t$  = Area/production/productivity/of onion in year 't'

t = Time elements which take the value 1, 2, 3, 4, .....n

a = Intercept

b = Regression coefficient

$u_t$  = Standard error term

Compound growth rates were worked out as follow:

$$\text{Compound growth rate (r)} = (b-1) \times 100$$

**Problems faced by the growers**

The information about the problems faced by the onion growers were ascertained from the selected respondents as well as from selected intermediaries on various aspects of onion marketing. The information regarding problem faced by the producer in production of onion were also collected from the selected respondents.

**RESULTS AND DISCUSSION**

**Trends in Area, Production and Productivity of Onion in Haryana**

It is evident from the Table 2 that in the period 1992-2013, the area and production of onion in Haryana recorded significant increase of 9.28 and 10.91 per cent per annum. Linear growth rate in case of productivity was increased by 1.42 per cent per annum. Compound growth rate of area, production and productivity recorded was 12.65, 14.27 and 1.35 per cent, respectively. The area of onion showed increase by 85.61 per cent in the year 2013 over the area under onion in the year 1992. The production of onion in Haryana increased by 89.37 per cent while productivity increased by 26.17 per cent during the study period. The maximum rate of increase was recorded in case of production. Similar findings were also reported by Pandita & Midmore (1994), Shukla *et al.* (2014).

**Constraints of Onion Production in Haryana**

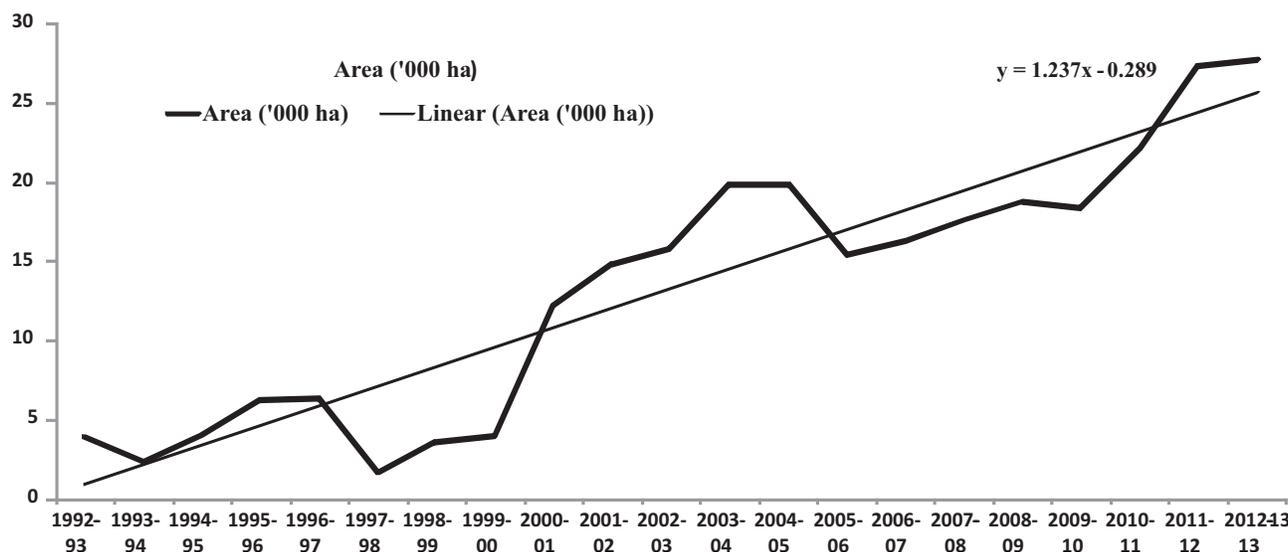
The Table 3 indicated that 74.44 per cent of the respondents were having lack of knowledge about

improved varieties, their seed/planting material, 72.22 per cent of the respondents having lack of knowledge about seeds or seedlings treatment, followed by high cost of seed (71.11 per cent), poor quality of seed (45.55 per cent) and non-availability of seed and planting material in time (25.55 per cent). These were the problems expressed by the growers regarding seeds and seed treatment. Majority (91.11 per cent) of the respondents were having problem of high cost of fertilizers followed by lack of knowledge about recommended fertilizer doses (82.55 per cent) and non-availability of fertilizers in time was expressed by 18.88 per cent, respectively. In case of water management (36.66 per cent) of the respondent told water shortage in summer and 15.55 per cent of the respondents told inadequate irrigation facilities in water management. With regards to weed management, 52.22 per cent of the respondents said that manual weeding was time consuming and labour intensive followed by labour problem for weeding and less effective and costly weedicides were the problems expressed by 51.11 per cent. In case of diseases and pest management, 86.67 per cent of the respondents told about difficulty in identifying the pests and diseases, 76.67 per cent of the respondents having lack of knowledge about the control measures for various pest and diseases, 62.22 per cent of the respondents having a problem of high cost of pesticides and 30.00 per cent of the respondents having a problem of non-curable nature of onion diseases with pesticide. In case of harvesting, labor problem (81.11 per cent) at harvesting time followed by lack of knowledge about improved method of harvesting were the problems expressed by the 70.00 per cent and lack of knowledge about proper harvesting time (17.78 per cent). With regards to storage, 52.22 per cent of the respondents had

**Table 2: Trend in area, production and productivity of onion in Haryana**

Year	Area ('000 ha)	Production ('000 MT)	Productivity (Tonnes/ha)
1992-93	4.00	64.20	16.05
1993-94	2.40	41.60	17.33
1994-95	4.10	67.90	16.56
1995-96	6.30	106.30	16.87
1996-97	6.40	109.50	17.11
1997-98	1.70	26.90	15.82
1998-99	3.70	53.26	16.89
1999-00	4.10	60.10	14.66
2000-01	12.20	153.90	12.61
2001-02	14.90	236.90	15.90
2002-03	15.90	226.10	14.22
2003-04	19.90	294.70	14.81
2004-05	19.90	294.70	14.81
2005-06	15.50	317.70	20.50
2006-07	16.40	314.90	19.20
2007-08	17.70	346.60	19.58
2008-09	18.80	347.90	18.51
2009-10	18.40	330.30	17.95
2010-11	22.20	453.90	20.45
2011-12	27.45	589.83	21.49
2012-13	27.80	604.47	21.74
Average	13.32	240.07	17.28
Slope	1.23	26.20	0.24
LGR (per cent p. a.)			
CAGR (per cent p. a.)	12.65	14.27	1.35

Source: National Horticultural Research and Development Foundation 2015



**Figure 1: Trend in area of onion in Haryana**

**Table 3: Production problems expressed by onion growers**

Constraints	Respondents (N=90)	
	Frequency	Percentage
<b>Seed and seed treatment</b>		
a. Lack of knowledge about improved varieties, their seed/planting materials	67	74.44
b. Lack of knowledge about/seed/seedling treatment	65	72.22
c. High cost of seed	64	71.11
d. Poor quality of seed	41	45.55
e. Non-availability of seed and planting material in time	23	25.55
<b>Fertilizer application</b>		
a. High cost of fertilizers	82	91.11
b. Lack of knowledge of recommended fertilizer doses	77	85.55
c. Non-availability of fertilizer in time	17	18.88
<b>Water management</b>		
a. Water shortage in summer	33	36.66
b. Inadequate irrigation facilities	14	15.55
<b>Weed management</b>		
a. Manual weeding is time consuming and labour intensive	47	52.22
b. Labour problem for weeding	46	51.11
c. Less effective and costly weedicides	37	41.11
<b>Disease and pest management</b>		
a) Difficulty in identifying the pests and diseases	78	86.67
b) Lack of knowledge about the control measures for various pests and diseases	69	76.67
c) High cost of pesticides	56	62.22
d) Non-curable nature of onion diseases	27	30.00
<b>Harvesting of onion</b>		
a) Lack of knowledge about proper harvesting time	73	81.11
b) Labour problem during harvesting	63	70.00
c) Lack of knowledge about improved method of harvesting	16	17.78
<b>Storage of onion</b>		
a) Lack of knowledge about curing and drying of onion	47	52.22
b) Lack of knowledge about grading	24	26.66
c) Lack of knowledge about improved storage structure	74	82.22
d) Costly storage facilities	86	95.55
e) Lack of knowledge about handling or care during storage	59	65.55

**Table 4: Marketing problems expressed by onion growers**

Problems	Respondents (N=90)	
	Frequency	Percentage
Open auction sale fetches low price for onion produce	35	38.89
Commission agent charge heavy commission	0	0.00
Commission agents not maintaining the proper records of sale and rate	38	42.22
Existence of large number of intermediaries in marketing process	54	60.00
Low and lack of remunerative prices	61	67.78
Non availability of market information	45	50.00
Mal practices adopted by market functionaries	61	67.78
High fluctuations in market prices	71	78.89
Inadequate transportation facilities	6	6.67
High transportation cost	53	58.89
Lack of appropriate credit facilities	52	57.78

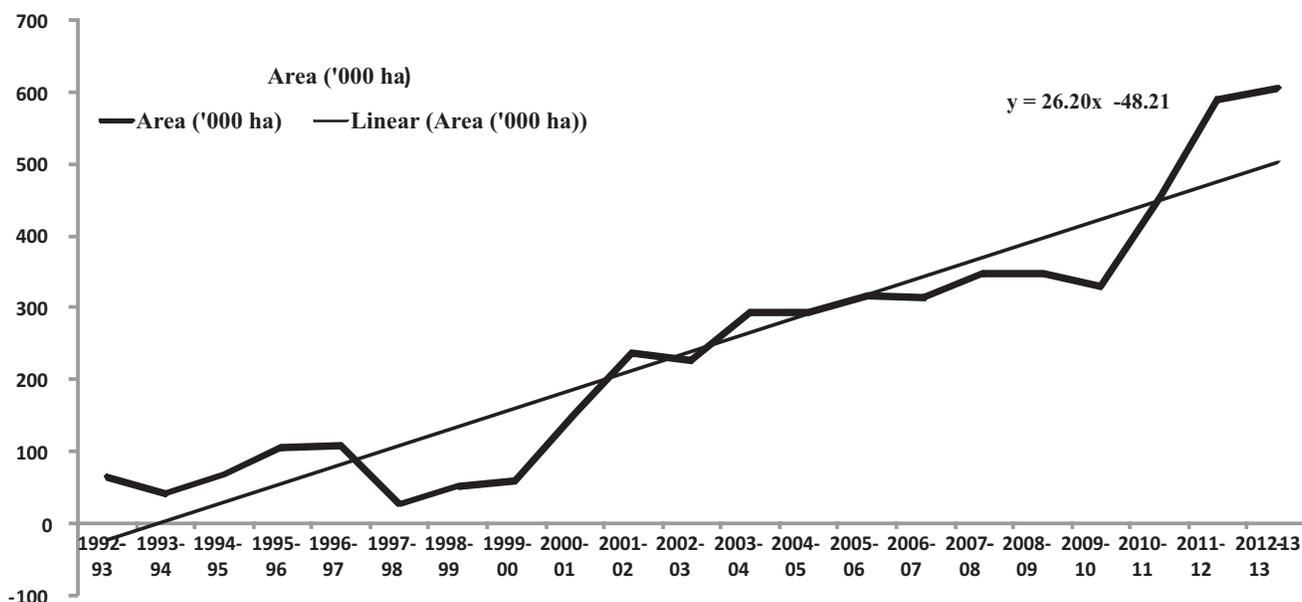


Figure 2: Trend in production of onion in Haryana

lack of knowledge about curing and drying of onion, 26.66 per cent of them had lack of knowledge about grading, while 82.22 per cent of them had lack of knowledge about improved storage structure, about 95.55 per cent of the respondents had a problem of costly storage facilities and 65.55 per cent of the respondents had a lack of knowledge about handling or care during storage of onion produce. Similar findings were also reported by Mali *et al.* (2003) and Nandal & Punia (2003).

#### Constraints of Onion Marketing in Haryana

From the contents of Table 4, it has indicated that 38.89 per cent of the respondents experienced that open auction sale fetching them low price of onion produce, commission agents not maintaining the proper records of sale and rate (42.22 per cent), existence of large number of intermediaries in marketing process (60.00 per cent), low price/lack of remunerative price (67.78 per cent), non availability of market information (50.00 per cent), malpractices adopted in market functionaries (67.78 per cent), high fluctuation in market prices (78.89 per cent), inadequate transportation facilities (6.67 per cent), high charges on transportation cost (58.89 per cent) and lack of appropriate credit facilities (57.78 per cent) were the major problems in marketing onion in order of merit. Similar findings were also reported by Vinayak *et al.* (2013) and Jayanthi & Vaideke (2014).

#### CONCLUSIONS

Onion is an important vegetable crop in India. Its cultivation has extended rapidly in Haryana. The area under onion has increase from 4.00 thousand hectares in 1992-93 to 27.80 thousand hectares in 2012-13. This has resulted in many marketing problems being faced by the producers as well as latest policy makers. Efficient marketing is an essential adjunct for increasing further production. In Haryana, area, production and

productivity of onion shows positive trend with compound growth rate of 12.65, 14.27 per cent and 1.35 per cent from the year 1992 to 2013. The major problem of production and marketing of onion was costly storage facilities, lack of knowledge of recommended fertilizer doses, lack of knowledge about the control measures for various pests and diseases, high cost of fertilizers, lack of knowledge about improved storage structure, labor problem during harvesting, lack of minimum support price, fluctuations in market prices, malpractices adopted by market functionaries and large numbers of middlemen exists in the marketing of onion.

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## Economics of Rice Cultivation in West Godavari district of Andhra Pradesh and Strategies to Reduce Cost of Cultivation

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### ABSTRACT

The present study was carried out in West Godavari district of Andhra Pradesh to investigate the cost of cultivation and profitability of rice particularly across different farm sizes during 2013-14. Multistage stratified random sampling technique was adopted for selection of the sample where rice cultivators were stratified into five groups based on the size of operational holding. The cost of cultivation for all the farms was found to be ₹64944.92 ha<sup>-1</sup> with lowest on small farms (₹62618.06ha<sup>-1</sup>) and highest on large farms (₹68598.46ha<sup>-1</sup>) implying that cost of cultivation increased with increase in farm size. Human labour constituted the major component (36.35 per cent) of the total cost of cultivation. The amount spent on fertilizers was highest on large farms (₹6877.86 ha<sup>-1</sup>). The cost of plant protection chemicals was found to be highest on large farms (₹7702.44 ha<sup>-1</sup>) and least on small farms (₹5423.78 ha<sup>-1</sup>) thus implying a direct relationship between cost incurred on plant protection chemicals and farm size. Low cost machines may be included in the government programmes and extension activities to reduce the cost of human labour. Wherever excessive fertilizer is used it has to be streamlined and the department of Agriculture can recommend the optimum dosage of fertilizers after conducting soil testing and also give wide publicity about the possible adverse impact on crop and soil if excessive fertilizer is used. Farmers should be encouraged to use organic pesticides which can be made at the farmers' home thus simultaneously making use of the livestock instead of costly plant protection chemicals.

### Keywords

Andhra Pradesh, cost of cultivation, farm sizes, profitability, rice, West Godavari

### JEL Codes

C83, D61, D24, Q12

### INTRODUCTION

Rice cultivation requires large quantities of inputs, particularly water, fertilizer and pesticides, contributing to high cost of cultivation. The management practices adopted in rice cultivation and costs incurred towards these practices have been on the rise over the years due to high cost of inputs. A general idea of cost of cultivation per hectare of various operations would help in estimating the returns and to find out the disparities, if any across the farm sizes. Returns from crop cultivation are essential not only for the survival of farmers but also facilitate reinvestment in agriculture (Narayanamoorthy, 2013). Hence the present study was taken up with the aim of investigating cost of cultivation and returns per hectare of rice according to farm size.

Rice is the most important and extensively grown

tropical food crop in the world. Because of its importance in providing national food security and generating employment and incomes for the low income sectors of society, most Asian governments regard rice as a strategic commodity (Hossain & Narciso, 2004). Rice is a primary food source for more than one-third of the world's population and grown in 11 per cent of the world's cultivated area. India is one of the leading rice producing countries in the world with a cultivated area of 43.94 million hectares and production of 106.54 million tonnes in the year 2013-14.

Rice is of key importance to the economy of the state of Andhra Pradesh and its people wherein a large percentage of labour force earns a living from agriculture by cultivating rice. The state has significant strengths in rice production enjoying the right conditions for growing

rice which is predominantly irrigated and is grown in all the districts of the state. Considering the importance of rice cultivation in promoting agricultural development in the country in general, in the state of Andhra Pradesh in particular and West Godavari district in specific, an attempt has been made in this study to estimate the costs and returns from rice cultivation across farm sizes.

## MATERIAL AND METHODS

Multistage stratified random sampling technique was adopted for selection of the sample with district as the first stage unit, mandals/tehsils as the second stage units, villages as the third stage units and farm holdings as the final and ultimate stage units. In the first stage, a district with highest production of rice was selected from Andhra Pradesh state based on the average rice production of preceding five years' i.e., from 2008-09 to 2012-13. Accordingly West Godavari district was chosen for the study (Figure 1). West Godavari District is one of the nine districts in the Coastal Andhra region of Andhra Pradesh and lies between 80° 50' and 81° 55'E of the eastern longitudes and 16° 15' and 17° 30'N of northern latitudes. The district is in the delta region of the Krishna and Godavari rivers.



Figure 1: Mandal map of West Godavari district

The region has a tropical climate similar to the rest of the Coastal Andhra region. The district is extremely fertile, getting water abundantly throughout the Sir Arthur Cotton barrage built on the Godavari River at Dhavaleswaram. The district is popularly known as the Granary of India since about 50 per cent of the state's rice production comes from the district. Topographically the district is divided into the Delta and the uplands. In the Delta rice, aquaculture, coconut and lemon are cultivated whereas in the uplands, oil palm, sugarcane, corn, mango, banana and other fruits as well as tobacco and cotton are produced. Farmers in the area call the *khari* and *rabi* seasons as *sarwa* and *dalwa* respectively.

Two mandals namely Unguturu and Ganapavaram were selected from the district based on three years' average rice production i.e., from 2010-11 to 2012-13. From each

mandal three villages were selected randomly. Thus a total of six villages were selected for the study. In each selected village, rice cultivators were stratified into five groups based on the size of operational holding viz., marginal (<1 ha), small (1-1.99 ha), semi-medium (2-3.99 ha), medium (4-9.99ha) and large (>10 ha) following the classification given by Agriculture Land use census, Ministry of Agriculture. From each farm-size group, four rice farmers were selected randomly making a total of twenty farmers from each selected village. Thus the sample consisted of 1 district, two mandals, six villages (three villages from each mandal) and 120 rice farmers (twenty from each village).

The data of the selected rice farmers were obtained through personal interview method with the help of pre-tested comprehensive interview schedule. The district level and mandal level data were collected from Directorate of Economics and Statistics, Hyderabad. Costs and returns from rice cultivation were generated following the cost of cultivation scheme (CCS) under the Government of India.

## RESULTS AND DISCUSSION

### Cost of Cultivation

The cost of cultivation for all the farms was found to be ₹64944.92 ha<sup>-1</sup> with 80.96 and 19.04 per cent of the total cost contributed by variable and fixed costs respectively. The lowest cost of cultivation was reported on small farms (₹62618.06 ha<sup>-1</sup>) and highest on large farms (₹68598.46 ha<sup>-1</sup>) implying that cost of cultivation increased with increase in farm size. Human labour constituted the major component (36.35 per cent) of the total cost of cultivation which confirms the labour-intensive nature of paddy cultivation followed by machine labour (21.19 per cent), plant protection chemicals (9.50 per cent), fertilizers (9.44 per cent), manures (6.94 per cent) and seed (2.53 per cent).

The expenditure on hired human labour was found to be highest on medium (₹21663.46 ha<sup>-1</sup>) and large farms (₹20596.44 ha<sup>-1</sup>) and least on marginal farms (₹11805.21 ha<sup>-1</sup>) while the contribution of family labour was highest on marginal farms (₹12686.35 ha<sup>-1</sup>) and least on medium farms (₹3125.00 ha<sup>-1</sup>). The use of family labour was not reported on large farms.

The cost incurred on hired human labour was positively related to farm size whereas participation of own farm labour was negatively related to farm size. Anantaramverma (1981); Ninan (1984) also reported that family labour was negatively related to farm size whereas hired labour was positively related to farm size.

The cost incurred on machine labour was highest on large farms (₹15830.73 ha<sup>-1</sup>) and least on medium farms (₹15078.13 ha<sup>-1</sup>). Most of the farmers who possessed tractors were large farmers (45.16 per cent) followed by medium (22.58 per cent), semi-medium (19.35 per cent), small (9.68 per cent) and marginal farmers (3.23 per cent). The contribution of machine labour to the total cost was 23.26, 23.02, 21.67, 19.70, and 18.90 per cent on large,

medium, semi-medium, marginal and small farms respectively.

The amount spent on seed ranged between ₹1559.38 ha<sup>-1</sup> on large farms and ₹1728.13 ha<sup>-1</sup> on medium farms. The variation in the price of seed might have been due to the variation in the sources of purchase by the farmers in the study area of West Godavari district. The sources of seed included own seed, seed from private dealers in respective villages or Tadepalligudem and Ganapavaram towns, market yard at Tadepalligudem, Pedapaadu (Foundation seed), KVK at Undi, Regional Agricultural Research Station at Maruteru, Primary Agricultural Cooperative Societies located at Narayanapuram, Gollagudem, Ganapavaram, Agriculture department of the state government and AP State Seeds Development Corporation Limited located at Tanuku. Subsidized seed

was available from AP State Seeds Development Corporation Limited, PACS and from the Department of Agriculture.

The amount spent on fertilizers was highest on large farms (₹6877.86 ha<sup>-1</sup>) while the cost incurred on manures was highest on marginal farms (₹5052.08 ha<sup>-1</sup>) and least on large farms (₹3750 ha<sup>-1</sup>). The cost of plant protection chemicals was found to be highest on large farms (₹7702.44 ha<sup>-1</sup>) and least on small farms (₹5423.78 ha<sup>-1</sup>) thus implying a direct relationship between cost incurred on plant protection chemicals and farm size. The percentage share of pesticides in the total cost was 11.32, 9.56, 9.07, 9.0, and 8.73 on large, medium, semi-medium, marginal and small farmers.

The total fixed cost for all the farms was ₹12374.45 ha<sup>-1</sup>. Rent paid for leased-in land and rental value of

**Table 1: Farm-size wise cost of cultivation in West Godavari district**

	(₹/ha)					
Item	Marginal	Small	Semi-medium	Medium	Large	All Farms
Seed	1664.58 (2.65)	1653.65 (2.64)	1614.58 (2.50)	1728.13 (2.62)	1559.38 (2.27)	1644.06 (2.53)
Fertilizer	5952.40 (9.47)	5934.58 (9.48)	5473.33 (8.47)	6430.89 (9.74)	6877.86 (10.03)	6133.81 (9.44)
Manures	5052.08 (8.11)	4208.33 (6.78)	5000.00 (7.78)	4531.25 (6.92)	3750.00 (5.51)	4508.33 (6.94)
Human labour	24491.56 (38.97)	23768.72 (37.96)	24449.78 (37.84)	24788.46 (37.53)	20596.44 (30.02)	23618.99 (36.35)
• Hired labour	11805.21 (18.94)	14281.77 (23.00)	20397.04 (31.74)	21663.46 (33.07)	20596.44 (30.27)	17748.78 (27.31)
• Family labour	12686.35 (20.36)	9486.95 (15.28)	4052.74 (6.31)	3125.00 (4.77)	-	7337.76 (11.29)
Machine	12278.65 (19.70)	11739.58 (18.90)	13927.08 (21.67)	15078.13 (23.02)	15830.73 (23.26)	13770.83 (21.19)
Plant protection chemicals	5638.61 (9.05)	5423.78 (8.73)	5830.84 (9.07)	6259.83 (9.56)	7702.44 (11.32)	6171.10 (9.50)
Interest on working capital	1259.06 (2.00)	1239.40 (1.98)	1260.91 (1.95)	1301.15 (1.97)	1327.58 (1.94)	1277.62 (1.97)
Operational Costs	52126.87 (82.95)	50987.14 (81.43)	52038.96 (80.53)	53346.96 (80.77)	54519.43 (79.48)	52603.87 (80.96)
Depreciation	182.85 (0.29)	225.76 (0.36)	632.01 (0.98)	555.41 (0.84)	1023.92 (1.49)	523.99 (0.81)
Land revenue, cess or taxes	343.65 (0.55)	332.92 (0.53)	291.88 (0.45)	284.58 (0.43)	340.00 (0.50)	318.60 (0.49)
Rental value of own land	9912.38 (15.77)	9857.65 (15.74)	10035.00 (15.53)	9903.93 (15.00)	9922.50 (14.46)	9926.29 (15.28)
Rent paid for leased-in land	8953.13 (14.25)	10128.21 (16.17)	10717.97 (16.59)	9525.00 (14.42)	10056.25 (14.66)	9876.11 (15.20)
Interest on fixed capital excluding land	1435.19 (2.28)	1937.50 (3.09)	3365.38 (5.21)	2674.34 (4.05)	3529.17 (5.14)	2588.32 (3.98)
Fixed costs	10718.15 (17.05)	11630.92 (18.57)	12746.12 (19.73)	12698.03 (19.23)	14079.03 (20.52)	12374.45 (19.04)
Total cost	62845.02 (100.00)	62618.06 (100.00)	64618.06 (100.00)	66045.02 (100.00)	68598.46 (100.00)	64944.92 (100.00)

Figures in parentheses are per cent to the total

owned land contributed to 15.20 and 15.28 per cent of the total cost while interest on fixed capital accounted for 3.98 per cent. Depreciation and land revenue constituted for 0.81 and 0.49 per cent of the total cost of cultivation. Highest fixed cost was observed on large farms (₹14079.03 ha<sup>-1</sup>) and least on small farms (₹10718.15 ha<sup>-1</sup>).

These results are in conformity with those of Neelappa (2002); Basavaraja *et al.* (2008); Vinay kumar *et al.* (2008); Sita & Ponnarasi (2009); Raj & Azeez (2011); Santha (1993); Rama Rao (2011); Shende & Bagde (2013) who also observed that variable costs constituted the major portion of the total cost of cultivation of which the expenditure on human labour was found to be the major item and per hectare cost of human labour was least on marginal farms.

As the cost of human labour is very high and found to be a major component of cost of cultivation low cost machines may be included in the government programs and extension activities. Research on the development and fine tuning of the existing machinery also must be encouraged. The information regarding the cost of cultivation according to cost concepts is presented in Table 2. The lowest values of cost A<sub>1</sub>, A<sub>2</sub>, B<sub>1</sub>, B<sub>2</sub>, C<sub>1</sub>, C<sub>2</sub> and C<sub>3</sub> were observed on marginal farms and highest on large farms. Thus a direct relationship was noticed between the costs and farm size. These results are in line with those of Yadav and Sinha (2004); Kumar *et al.* (2013). Rahman *et al.* (2012) who also showed that costs were lowest on marginal farms and increased with increase in farm size.

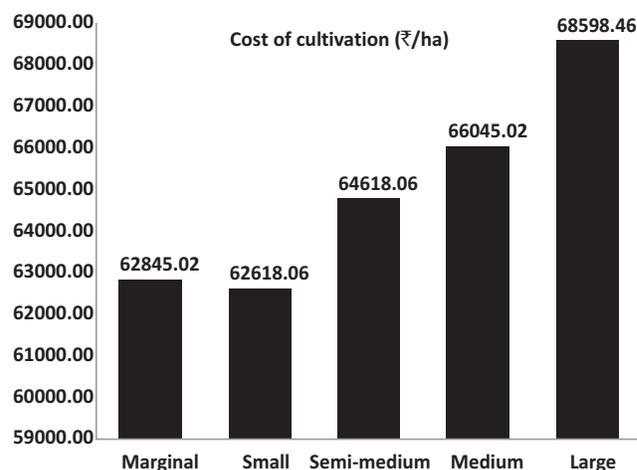


Figure 2: Cost of cultivation of rice farms

### Returns from rice cultivation according to farm size

To find the profitability of farm business, gross income, net income, family labour income, farm business income and farm investment income were worked out and presented in Table 3. Gross income was found to be highest on large farms (₹70658.33 ha<sup>-1</sup>) where as net income was highest on medium farms (₹3126.86 ha<sup>-1</sup>). Family labour income and farm business income were found to be highest for marginal farms. Returns per rupee investment were highest for small and medium farms (1.05) indicating that these farms were more profitable in rice cultivation compared to other farm sizes.

Table 2: Cost of cultivation according to farm sizes

Farm size	Cost A <sub>1</sub>	Cost A <sub>2</sub>	Cost B <sub>1</sub>	Cost B <sub>2</sub>	Cost C <sub>1</sub>	Cost C <sub>2</sub>	Cost C <sub>3</sub>
Marginal	39867.97	41360.16	40406.16	50158.66	53092.52	62845.02	69129.52
Small	41983.61	44937.67	43194.55	53131.11	52681.50	62618.06	68879.86
Semi-medium	49997.68	53570.33	51820.59	62083.25	54522.42	64618.06	71079.87
Medium	53941.06	55131.69	56058.25	65914.81	56188.46	66045.02	72649.52
Large	55712.70	57388.74	58653.67	68598.46	58653.67	68598.46	75458.31
<b>All farms</b>	<b>48300.60</b>	<b>50477.72</b>	<b>50026.64</b>	<b>59977.26</b>	<b>55027.71</b>	<b>64944.92</b>	<b>71439.41</b>

Table 3: Returns from rice cultivation

Farm size	Gross income	Net income	Family labour income	Farm business income	Farm investment income	B-C ratio
Marginal	65354.95	2509.93	15196.28	23994.79	11308.44	1.04
Small	65633.85	3015.80	12502.74	20696.18	11209.23	1.05
Semi-medium	67499.09	2714.01	5415.84	13928.76	11226.93	1.04
Medium	69171.88	3126.86	3257.06	14040.19	13909.98	1.05
Large	70658.33	2059.87	2059.87	13269.59	13269.59	1.03
<b>All farms</b>	<b>67663.62</b>	<b>2685.29</b>	<b>7686.36</b>	<b>17185.90</b>	<b>12184.83</b>	<b>1.04</b>

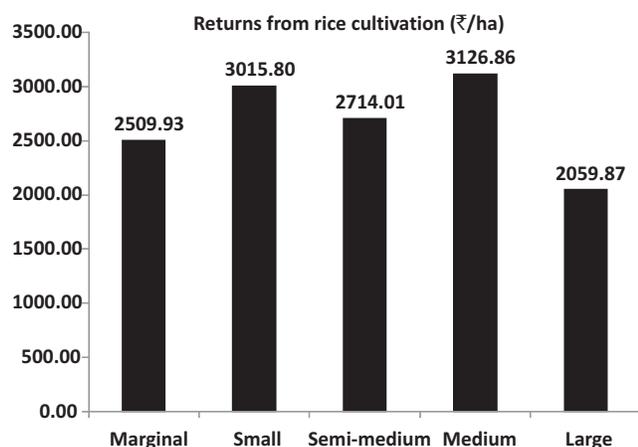


Figure 3: Returns from rice cultivation

## CONCLUSIONS

The study revealed that cost of cultivation of rice increased with increase in farm size. Human labour constituted the major component of the total cost of cultivation which confirms the labour-intensive nature of paddy cultivation. Hence low cost machines may be included in the government programmes and extension activities. Research on development and fine tuning of the existing machinery may also be taken up.

The cost incurred on hired labour was found to increase with farm size whereas the cost incurred on family labour decreased with increase in farm size. The amount spent on fertilizers and plant protection chemicals was highest on large farms. Wherever excessive fertilizer is used it has to be streamlined and the department of Agriculture can recommend the optimum dosage of fertilizers after conducting soil testing and also give wide publicity about the possible adverse impact on crop and soil if excessive fertilizer is used.

High cost incurred on pesticides has to be minimized. Government should keep a watchful eye and take strict action on those pesticide dealers and shop owners who earn profits by selling expensive, spurious and fake pesticides to the farmers. Farmers should be encouraged to use organic pesticides which can be made at the farmers' home thus simultaneously making use of the livestock instead of costly plant protection chemicals.

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## **Price Fluctuation and Market Integration of Chilli Crop in Telangana State**

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### **ABSTRACT**

*The objectives of the study are to know the price fluctuation and long run relationship between chilli markets in Telangana state. The secondary data were collected from DES, Hyderabad. The study reveals that in both the Khammam and Warangal markets, the highest and lowest arrivals of seasonal indices were observed during the month of March and January, respectively. The study indicates that prices series are stationary in first difference logarithm. The results of Johannsen's cointegration test showed that the price series are cointegrated and the results of the Granger causality test indicated that in the long run there was a two direction relationship between market prices of Khammam and Warangal.*

### **Keywords**

Chilli, India, market integration, price fluctuations, Telangana, VECM

### **JEL Codes**

C01, C22, C32

### **INTRODUCTION**

Diverse agro-climatic conditions of India provide ample scope for cultivation of as many as 63 different spices, which are being cultivated in the country since ancient times, on account of this, India is known as the Land of Spices. India is the world's largest producer, consumer (37.2 per cent) and exporter (26 per cent) of chillies in the world. India also has the largest area under chillies in the world. Chillies are the most common spice cultivated in India. It is estimated that India produced 10.65 lakh tons of dry chili from an area of 7.61 lakh hectares in 2014-15. In India chilli growing states are Andhra Pradesh (46 per cent), Telangana (26.20 per cent), Karnataka (15 per cent), Maharashtra, Madhya Pradesh, Orissa, West Bengal, Rajasthan and Tamil Nadu. It can be grown during the entire year at one or the other part of the country. However, the major arrival season extends from February to April.

India is the largest consumer of chilli in the world. Around 90 per cent of India's production is consumed within the country. India exports around 80000-100000 tons of chillies in a year. India exports chillies in the form of dried chillies, chilli powder, picked chillies and chilli oleoresin. Indian chilli is mainly exported to USA (26 per cent), Sri Lanka (24 per cent), Bangladesh (13 per cent), Malaysia (6 per cent), Nepal (3 per cent), others (28 per cent).

Telangana state ranks second both in area (2.53 lakh ha) and production (2.79 lakh tons) with a productivity of 2.1 MT/ha. The state accounts for 26.20 per cent of India's production. In Telangana, the major chilli growing belts are Khammam, Bhadrachalam and Warangal. Khammam ranks first both in area (0.28 lakh ha) and production (0.77 lakh tonnes) of chilli with productivity of 3453 kg/ha. (Anonymous, 2014-15). The area under chillies has been continuously increasing from 0.20 lakh ha in 2002-03 to 0.28 lakh ha in 2014-15. There is only one regulated market in Khammam in the marketing season of chilli is December to April. The traditional markets to which the chilli from Khammam market is sent are Calcutta, Bombay, Varanasi, Nagpur, and Delhi. Average daily arrivals in Khammam market throughout season of chilli is 366.2 Metric Tonnes with maximum daily arrival in the market 3120 MT and Minimum daily arrivals in the market 0.8 MT as per 2014-15. Total annual arrival of chilli in Khammam market by 2014-15 is 70615 MT.

### **Importance of Market integration**

Cointegration is a statistical property possessed by some time series data that is defined by the concepts of stationarity and the order of integration of the series. A stationary series is one with a mean value which will not vary with the sampling period. Cointegration is an econometric concept which

mimics the existence of a long-run equilibrium among economic time series.

If two or more series are themselves non-stationary, but a linear combination of them is stationary, then they are said to be cointegrated. Cointegration technique has been extensively employed to investigate relationship among price variables. The two widely used cointegration methods are Johansen and Engle-Granger two-step approaches. However these methods assume symmetric relationship between variables. The cointegrated variables will never move far apart, and will be attracted to their long-run relationship. Testing for cointegration implies testing for the existence of such a long-run relationship between economic variables.

Market integration occurs when prices among different locations or related goods follow similar patterns over a long period of time. Groups of prices often move proportionally to each other and when this relation is very clear among different markets it is said that the markets are integrated. Market integration concept explains the relationship between two markets that are spatially or temporally separated. The study on integration can suggest to the product as to where, when and how much to sell, which in turn will have bearing on the production strategies and hence resource allocation. Spatial price relationships have been widely used to indicate overall market performance. Integrated markets are those where prices are determined interdependently. Efficient functioning of markets provides remunerative prices for the produce of the farmer-sellers as well as provides goods at reasonable prices to the innumerable consumers. One of the common indicators of an efficient functioning of the markets is existence of high degree of integration among them. The concept of market integration increased importance over recent year particularly in developing countries where it has potential application to policy questions regarding government in markets. Reddy (2012) reported that there is weak integration of chickpea markets in India. Overall, there is evidence of weak cointegration in the chickpea markets in North India and imports and major consuming centres are playing an important role in price discovery in domestic chickpea markets.

Based on above background, the following study has been conducted with objectives like (i) to study the price fluctuation in chilli markets in Telangana state (ii) to study the long run relationship between chilli markets in Telangana state.

## **METHODOLOGY**

### **Study Area**

Telangana state ranks second both in area (2.53 lakh ha) and production (2.79 lakh tonnes) with a productivity of 2.1 MT/ha. The Telangana state accounts for 26.20 per cent of total India's production. In Telangana, the major chilly growing belts are Khammam, Bhadrachalam and Warangal. It was noticed that the Khammam market ranks first both in area (0.28 lakh ha) as well as production (0.77 lakh tonnes) of chilli with productivity of 3453 kg/ha (Anonymous, 2014-15). Hence, Khammam and Warangal markets were chosen to study the integration of markets in Telangana state.

### **Data Sources and its Collection**

The secondary data on area, production and productivity of chilli crop were collected from Directorate of Economics and Statistics, Hyderabad and various others sources. The secondary data on monthly prices and arrivals from two major chilli markets in the state-Khammam and Warangal were collected for a period of 14 years from January, 2002 to December, 2016 from Market information centre of Khammam market and Warangal market, respectively.

### **Analysis Tools Used**

First, the order of integration of the time series data is tested. Next, if these series are integrated of the same order, then a cointegrating regression is estimated and the null hypothesis that the residuals of that regression are non-stationary is tested. Only if non-cointegration is rejected would the estimation of an ECM be attempted.

The most frequently used test for the cointegration rank is the likelihood ratio (LR) test. Its popularity stems from the fact that it is conceptually simple since it an LR test and the test statistic is easy to compute by reduced rank regression. However, many studies have shown that the small sample distribution is not well approximated by the limiting distribution (Johansen, 1988).

The distribution of the likelihood ratio statistic in finite samples depends on the parameters. A good account of understanding on cointegration can be obtained from Lütkepohl (2005), Greene (2000), Harris & Sollis (2003), to name a few. The likelihood ratio test of cointegration rank has been extensively used with financial time series.

Augmented Dickey-Fuller (ADF) test and Philips-Perron were used to test the stationarity of time series data on chilli price in each market at the levels and first differencing. Johansen's Multiple Co-integration test was used to determine the long run relationship between the price series of selected chilli markets. Granger Causality (Granger, 1969) test was used to know the direction of causation between the markets. Vector Error Correction Model (VECM) was employed (Engle & Granger, 1987) to know the speed of adjustments among the chilli markets for short run equilibrium.

## **RESULTS AND DISCUSSION**

Over a period of time the average arrivals of chillies is increasing (Figure 1) in both Khammam and Warangal districts. Peak arrivals were received in April and lowest arrivals were received in the month of October followed by September in both Khammam and Warangal markets. In both the markets the highest and lowest arrivals of seasonal indices were observed during the month of March and January respectively. The highest price was recorded during the month February while the lowest was observed during the month of July in Khammam. The highest price was recorded during the month of March while the lowest was observed during the month of May in Warangal. A well-defined (Figure 2 and 3) cycle was observed for arrivals in both markets, which could not be observed regarding the prices of both Khammam and Warangal markets. The Table 1 shows that there is more seasonal price variation in January month followed by in both Khammam and Warangal markets

On testing co integration analysis the following results were found the results of ADF unit root test (Table 2) showed

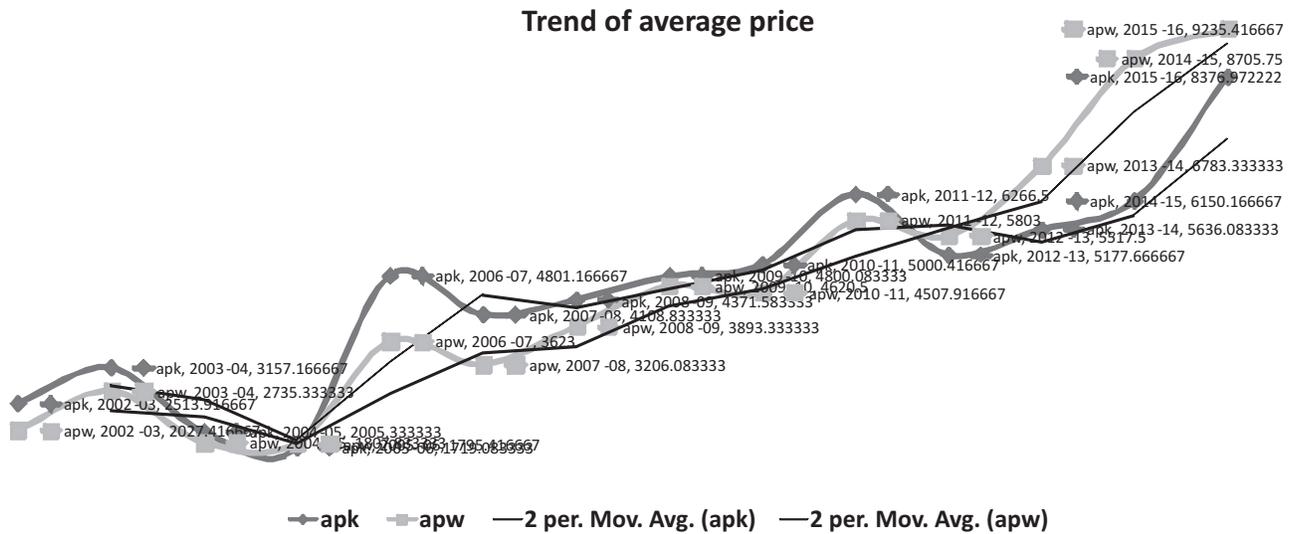


Figure 1: Trend in chilli market prices in Khammam (apk) and Warangal (apw)

that prices series are stationary in first difference logarithm. Results of Johansen’s cointegration test showed that the price series as cointegrated and the results of the Granger causality test indicated that in the long run there was a two (Table 3)

Table 1: Seasonal Indices of prices of Khammam and Warangal markets

Months	SI of Khammam market		SI of Warangal market	
	Mean	Index (Per cent)	Mean	Index (Per cent)
April	23020.69	97.88	24565.46	107.92
May	22745.23	96.71	23537.54	103.41
June	22454.08	95.47	21468.29	94.32
July	22121.46	94.06	20538.71	90.23
August	21611.08	91.89	19870.62	87.30
September	21962.62	93.38	19776.83	86.89
October	22886.00	97.31	20770.33	91.25
November	24158.23	102.72	22283.76	97.90
December	25266.46	107.43	23822.83	104.66
January	26706.15	113.55	25793.64	113.32
February	24808.92	105.48	25297.85	111.14
March	24477.67	104.07	25401.00	111.60

directional relationship between market prices. There is bidirectional (Table 3) causality affected on chilli prices of Khammam-Warangal markets in Telangana state.

Results (Table 4) of Vector Error Correction model (VECM) showed that Warangal and Khammam markets attain short run equilibrium rapidly. The results indicated that one month lag price of Khammam is affecting current prices of Warangal market. Two month lag price of Khammam is affecting current prices of Khammam market itself and Warangal market. One month lag price of Warangal is affecting the current price of that market and Khammam market. Two month lag price of Warangal if affecting the current price of Khammam. The results of the study is clearly revealing that there is scope for increasing chilli production through efficient production technologies on suitable lands as all the major markets existing in the Telangana state are favouring in terms of price integration and the government

Table 3: Granger causality test-Testing for pair-wise Granger causality

Markets	F-Statistic	Prob.	Direction
Khammam-Warangal	9.4731	0.001	↔
Warangal- Khammam	5.56113	0.0046	

From the table we observe that there is bidirectional causality affected on chilli prices of Khammam – Warangal

Table 2: Testing stationary-Results of augmented dickey-fuller and Phillips Perron tests

Series	Original series			1 <sup>st</sup> differenced series		
	ADF		PP	ADF		PP
	Lag	t-statistic		Lag	t-statistic	
Khammam	1	-1.53	-1.80	1	-11.35	-11.47
Warangal	1	-0.55	0.093	1	-12.98	-12.98

5 per cent critical value for ADF and PP statistics is -2.92 and -3.57 respectively

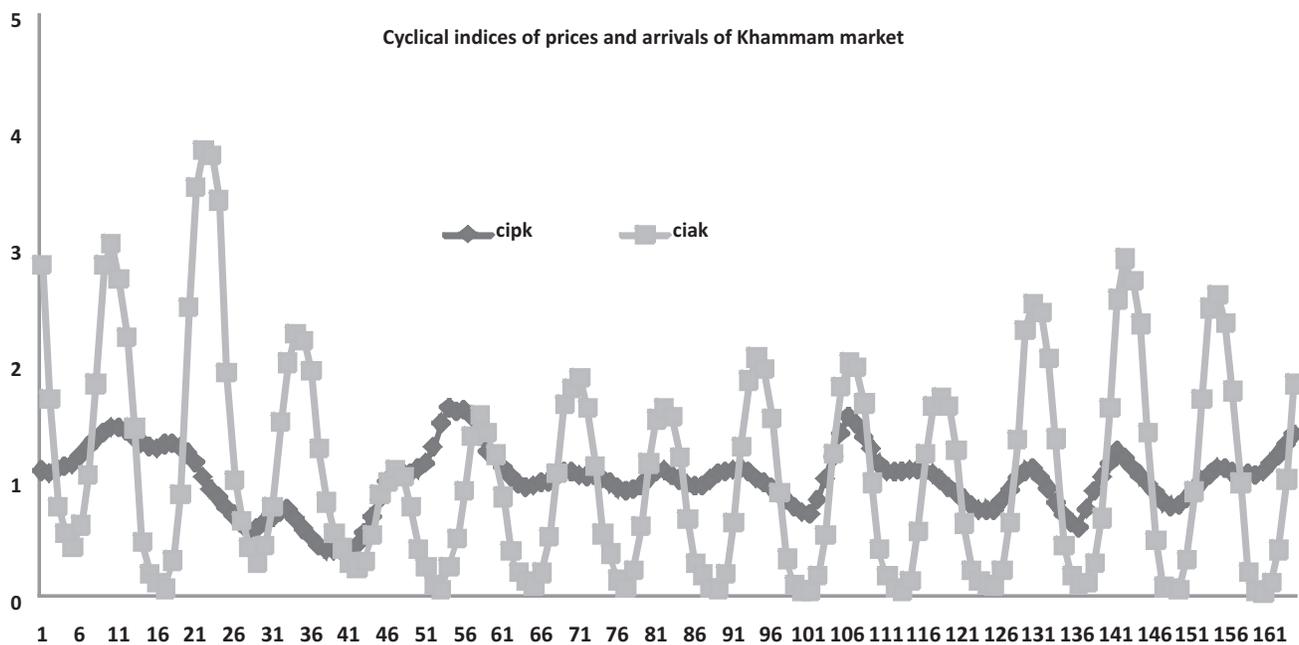


Figure 2: Cyclical indices of price and arrivals of Khammam market

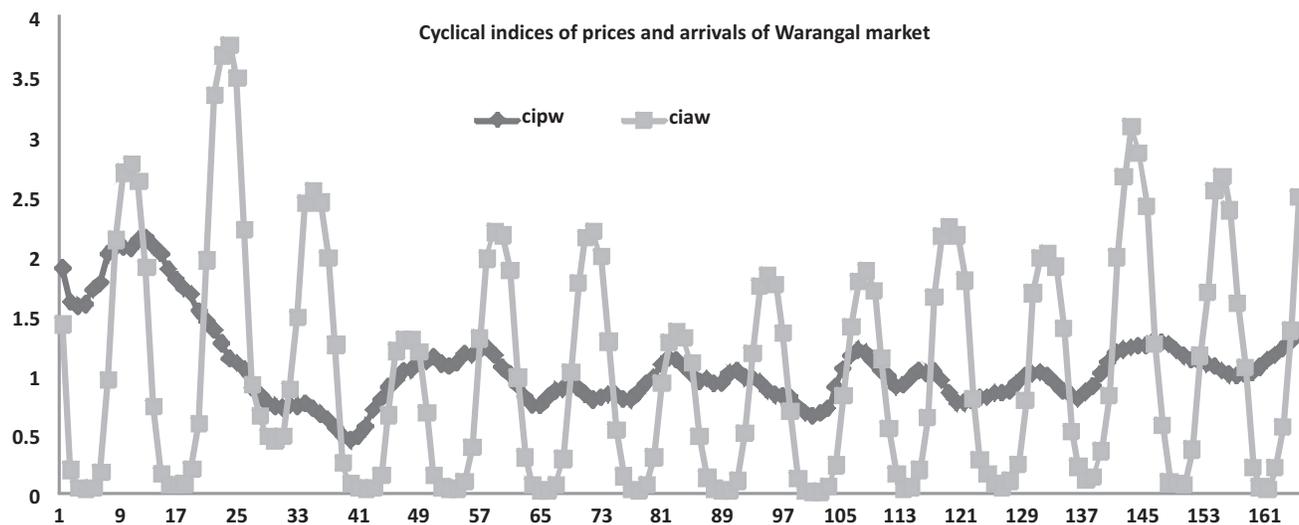


Figure 3: Cyclical indices of prices and arrivals of Warangal market

Table 4: Results of Johansen's multiple Co-integration test for chilli price: Co integration among the chillies price series in selected markets

No. of CE(s)	Eigen value	Trace statistic	Critical value	Prob.	Max-Eigen statistic	Critical value	Prob.
None *	0.463189	144.36	15.49	0.0001	102.02	14.26460	0.0000
At most 1 *	0.227514	42.33	3.84	0.0000	42.33	3.84	0.0000

Above co-integration equations at 5 per cent level of significance indicates that the selected chilli markets are having long run equilibrium relationship and there exists co-integration between them.

through support prices.

#### **CONCLUSIONS AND SUGGESTIONS**

The study shows that prices in both markets exhibits increasing trend over period of time. A well-defined cycle was observed for arrivals in both markets whereas cycle could not be observed for the prices of both Khammam and Warangal markets. The study indicates that there is a bidirectional causality affected on chilli prices of Khammam-Warangal markets in Telangana state. The results of Vector Error Correction model showed that Warangal and Khammam markets attain short run equilibrium rapidly. It indicates that two month lag price of Khammam is affecting current prices of Khammam market itself and Warangal market. Whereas Two month lag price of Warangal affecting the current price of Khammam only. The results of the study is clearly revealing that there is scope for increasing chilli production through efficient production technologies on suitable lands as all the major markets existing in the state are favoring in terms of price integration and the government through support price.

In order to reduce the instability in price fluctuations of chilli, there is a need to have a thorough understanding of the price behavior over time and over space. Therefore it is essential that there must be transparency in prices and should be provided with the good infrastructure of the market and farmers should be informed clearly about the prices so that they could sell their price at a good price and get profits.

Efficient market services should be provided.

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## **A Critical Analysis on Economics and Constraints in Chilli Cultivation in Raigarh District of Chhattisgarh**

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### **ABSTRACT**

The present study was undertaken to study the A critical analysis on economics and constraints in chilli cultivation in Raigarh district of Chhattisgarh. Data were collected through personal interview from 110 randomly selected respondents of the ten villages viz. Economic analysis of data indicated that per hectare cost of chilli cultivation estimated to be ₹128128.10, ₹ 130302.58, ₹ 126556.02 and ₹105297.59 for marginal, small, medium and large farms respectively. Net returns was ₹ 97536.07, ₹ 116064.30, ₹ 163791.20 and ₹ 184081.30 per hectare and input-output ratio was 1:1.76, 1:1.89, 1:2.29 and 1:2.75 for marginal, small, medium and large farms respectively. On the basis of information collected from the chilli growers, the main problem in production faced by them were insect-pest and diseases (81.82 per cent), imbalance use of fertilizers and pesticide (76.36 per cent) scarcity of labours (54.55 per cent), Non institutional support (45.45 per cent), problem in marketing faced by these farmers were lack of regulate market (28.18 per cent).

### **Keywords**

chilli cultivation, farmers' constraints, production

### **JEL Codes**

D12, D20, D33, D40, Q10, Q11, Q12, Q13

### **INTRODUCTION**

Chilli is considered as one of the commercial spice crops. Named as wonder spice, it is the most widely used universal spice. Different varieties of chilli are cultivated for varied uses like vegetables, pickles, spices and condiments. In daily life chillies are integral and the most important ingredient in many different cuisines around the world as these add pungency, taste, flavour and colour to the dishes. India is the world leader in chilli production followed by China and Pakistan. Indian chilli is considered to be world-famous for two important commercial qualities-colour and pungency levels. Some varieties are famous for the red colour because of the pigment. Other quality parameters of chilli include length, width and skin-thickness. The bulk share of chilli production is held by Asian countries, though it is produced throughout the world. A large demand for chilli comes from several chilli-consuming countries such as India, China, Mexico, Thailand, US, UK, Germany and Sweden. Indian share in global production is 50 to 60 per

cent. However, India is the only source for hot chillies (Thamaraikannan *et al.*, 2011).

India is a major producer, exporter and consumer of chilli. The area and production of chilli in the country is 7.94 million hectare and 13.04 million tonnes respectively. In India, chillies are grown in almost all states of the country and the major growing states in terms of production are Andhra Pradesh (52.53 per cent), Karnataka (8.20 per cent), West Bengal (7.67 per cent), Madhya Pradesh (7.17 per cent), Odisha (5.37 per cent), Gujarat (5.25 per cent), and Maharashtra (3.50 per cent) which constitutes more than 90 per cent of the total production of chilli in the country. The average productivity in the country is around 1.64 metric tonnes per hectare which varies 0.60 metric tonnes in Manipur to 3.26 metric tonnes per hectare in Andhra Pradesh (Indian Horticulture Database 2013).

The total area under spices is 92769 hectare in the Chhattisgarh state with a production of 632031 metric tonnes. Chilli is the important vegetable and spice crop of

the Chhattisgarh state with area under production of 5460 hectare and 8300 tonnes respectively and productivity of this crop is estimated as 1.52 metric tonnes per hectare during 2012-13. The dry climate during the ripening of fruit is ideal condition therefore there is lot of scope to improve the productivity of this crop in the state as we are behind from several countries like Bangladesh, Pakistan, Thailand, Nigeria, Mexico and China in case of productivity. More over the productivity of this crop in our state is less than other states like Andhra Pradesh, West Bengal, Madhya Pradesh, Gujarat and Punjab.

#### METHODOLOGY

The present study pertains to Raigarh district of Chhattisgarh state. To accomplish the objective of the study two blocks of the district, namely Dharamjaygarh and Pusoar blocks were purposively selected. Accordingly eleven villages were selected randomly from these two blocks for the study. From each of the selected villages, ten number of chilli growers i.e. 110 chilli growers were considered for the present study. These farmers were classified into different categories based on their land holding i.e. marginal (up to 1.00 ha), small (1.01 ha to 2.00 ha), medium (2.01 ha to 4.00 ha) and large (above 4.00 ha) farmers. The required data from the respondents were collected in an informal atmosphere using pre-tested interview schedule. The information was tabulated and analyzed by using frequency and percentages. The whole information is related to the crop year 2013-2014.

#### RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized below:

##### Economics of Chilli Production at Sampled Farms

The economics of chilli production at sample farms is presented in Table 1. The average cost of cultivation was estimated as ₹122935.62. The maximum cost of cultivation of chilli was recorded at small farms as

₹130302.58 per hectare followed by marginal farms ₹128128.10 per hectare, medium farms ₹126556.02 per hectare and large farms ₹105297.59 per hectare respectively. Similar types of results were also obtained in the studies conducted by Dass (2005) and Jagtap *et al.*(2012). The average production of chilli (green) was worked out as 117.40 quintal per hectare which ranges from about 95.81 quintal per hectare at marginal farms to 141.31 quintal per hectare at large farms. In case of red chilli the average production was observed as 1.04 quintal per hectare which range from 0.22 quintal, 0.90 quintal and 3.07 quintal per hectare at small, medium and large farms respectively. These findings are in conformity with the findings of Naik *et al.* (2012). The cost of production per quintal, on an average, was worked out as ₹1047.15. The per quintal cost of production of chilli was estimated at ₹ 1337.31, ₹1216.53, ₹1024.35, and ₹745.15 at shows that per quintal cost of production was decreasing marginal, small, medium and large farm respectively. It with the increase in the size of farms due to higher yields realized at relatively large farms. The average gross return was observed as ₹ 257072.66 per hectare in the study area which ranges from ₹225664.17 per hectare at marginal farms, to ₹308020.39 per hectare at large farms. The gross return depends upon variety, productivity and price received by the farmers.

The average net return was observed as ₹ 127451.60 per hectare. It was estimated as ₹ 97536.07 per hectare, ₹ 116064.30 per hectare, and ₹163791.20 per hectare and ₹ 184081.30 per hectare at marginal, small, medium and large farms respectively. The average input-output ratio was observed as 1:2.04 and it varied from 1:1.76 at marginal farms to 1:2.75 at large farms.

##### Constraints in Production and Marketing of Chilli

The farming is gradually becoming more and more commercialized with the time and advancement in crop

Table 1: Economics of chilli production at sampled farms

Particular	₹/ha (n=110)				
	Marginal	Small	Medium	Large	Average
<b>Average yield (q/ha)</b>					
Green chilli	95.81	107.11	123.50	141.31	117.40
Red chilli	-	0.22	0.90	3.07	1.04
<b>Average price (₹/q)</b>					
Green chilli	2355.33	2300.13	2350.99	2047.83	2132.77
Red chilli	-	7925.93	7277.17	6072.16	6428.33
Gross returns from green chilli	225664.17	246366.92	290347.26	289378.86	250387.20
Returns from red chilli	-	1743.70	6549.45	18641.53	6685.46
Gross returns (₹/ha)	225664.17	248110.62	296896.71	308020.39	257072.66
Cost of cultivation(₹/ha)	128128.10	130302.58	126556.02	105297.59	122935.62
Net returns (₹/ha)	97536.07	116064.30	163791.20	184081.30	127451.60
Cost of production (₹/q)	1337.31	1216.53	1024.75	745.15	1047.15
Input output ratio	1:1.76	1:1.89	1:2.29	1:2.75	1:2.04

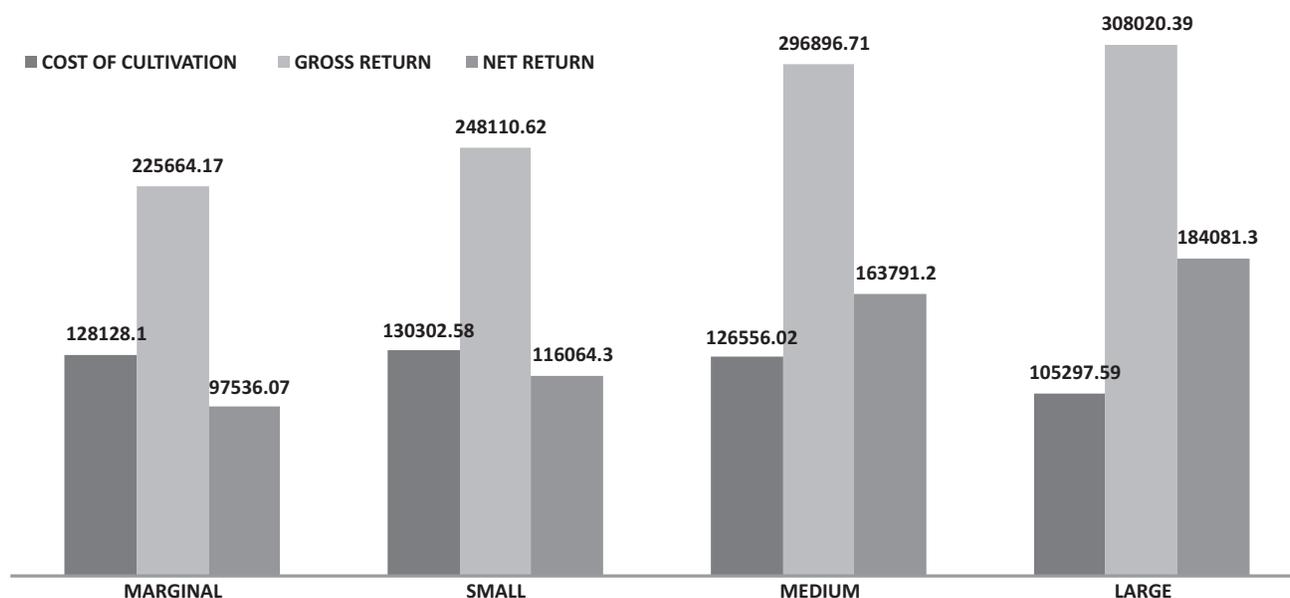


Figure 1: Per hectare cost and returns of chilli crop at different farms

Table 2: Production and marketing problems faced by the chilli growers

(N= 110)

Particulars	No. of farmers	Percentage of total No. of farmers
<b>Production problems</b>		
Problem of insect- pest and diseases	90	81.82
Imbalance use of fertilizer & pesticide	84	76.36
Lack of soil testing facility	70	63.64
Scarcity of labour	60	54.55
Lack of institutional support	50	45.45
High cost of pesticide	41	37.27
High cost of hybrid seeds	30	27.27
Lack of latest technical know-how about chilli production	24	21.82
<b>Marketing problem</b>		
Lack of regulate market and co-operative market	31	28.18

production technology. Now it aims at increasing per unit productivity of land, labour, and other scarce means of farm resources. In this process, the problems faced by farming community have greater significance. All the selected chilli growers were interviewed for the problems they are facing while producing and marketing of chilli. The information regarding the important problems faced by the growers is presented in Table 2.

Irrespective of farm size, most of the farmers reported that insect- pests and diseases were the major problems, specially leaf curl, powdery mildew and fruit borers. Ninety out of 110 farmers (about 80 per cent) faced the problems of insect-pests and diseases in the study area. These Farmer's suggested that diseases and insect pest resistant varieties must provide to the

farmers. Another important aspect perceived by about 76 per cent farmers was imbalance use of fertilizers and pesticide at all categories of farms. Lack of latest technical know-how may be a reason for this imbalanced use of fertilizers and pesticide. Therefore it is needed that the department of agriculture should arrange periodically training programmes to aware the farmers about balanced use of fertilizers, pesticide and other technical knowledge. Problem faced by 63.64 per cent farmers was lack of sufficient soil testing facilities. Farmers perceived that the soil testing equipments should be available at least at block level along with recommended dose of fertilizer and manure according to the soil test. The other most important constraint was non availability of labour during peak season faced by

chilli growers of Raigarh district. The scarcity of labour was reported to be serious problem faced by 54.55 per cent of the farmers. About 45 per cent farmers do not have any institutional support in chilli production like supply of seed, supply of plant protection chemical and technical support. Table 2 reveals that there was no serious problem in marketing of chilli by the chilli growers due to highly demand of this crop; however certain problems like lack of regulated and co-operative markets are reported by about 30 per cent farmers of the study area. These findings are in conformity with the findings of Dangore *et al.* (2015); Jagtap *et al.* (2012); Pandit & Basa (2013); Sharma & Gupta (2009).

#### SUGGESTIONS

Based on the findings of this study the following suggestions are made to improve the production and marketing of chillies in Chhattisgarh state.

1. Development of disease resistant, high yielding varieties of chillies may be taken up to increase the production and profitability of the producers.
2. The government should make adequate arrangement for timely supply of quality seeds and other inputs at reasonable prices to the growers to increase the productivity of chillies.
3. The cultivation of chilli is labour intensive and the farmers faced the problem of non-availability of labour. Hence, there is a need to bring mechanization in the production and post-harvest management of chilli.
4. The government should set up and promote co-operative societies, which may collect the produce from the producers especially from marginal and small producers for transportation and selling in the terminal markets.
5. The farmers in the study area are using more quantity of pesticide. This is not only uneconomical but also leads to other ill effects on human beings. Therefore there is a need to organize the training programmes to increase the awareness among the farmers to use balanced doses of pesticides.
6. It is also observed that chilli picking is a costly operation. It is therefore suggested that the picking on contractual basis should be adopted by farmers in order to reduce the cost of cultivation.
7. Most of the farmers have applied imbalanced dose of N.P.K. and therefore soil testing facilities should be established at least block level. This step will reduce the cost of cultivation at one side and will improve the soil fertility on the other.

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## Bitter Gourd (*Momordica charantia* L.) Cultivation for Increasing Income and Promoting Health Benefits in Punjab<sup>#</sup>

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### ABSTRACT

*Momordica charantia* L. cucurbitaceae (bitter gourd) is a good source of carbohydrates, proteins, vitamins, minerals and have the highest nutritive value among cucurbits. The present study was undertaken to examine its production, cost/return structure, market system/potential based on experience of 53 bitter gourd producers spreading over 14 villages of two districts of Punjab and 400 consumers surveyed for their consumption pattern of bittergourd vegetable during 2012. Majority of the respondents under took the production of bitter gourd at small scale and adopted pandal cultivation using hybrid varieties to produce light green medium size variety of bitter gourd, keeping in view consumers' preferences. Overall gross returns were found to be ₹365370 as against total cost of ₹126557, leaving behind ₹238813 as net returns per hectare. On an average, per kg total cost of output was estimated to be ₹5.98. The profit margin was estimated to be 65.57 percent. Marketing of produce to wholesalers was the most preferred marketing outlet of majority of the farmers in Punjab. The market potential of bitter gourd crop was found to be quiet high as the consumer were ready to dole out additional rupees per kg for the enhanced quality of lowering the blood glucose level and for having all the other properties (blood pressure and cholesterol) of bitter gourd.

### Keywords

Bittergourd, functional property, productivity, profitability, willingness to pay

### JEL Codes

I115,Q 12,Q13. Q18

### INTRODUCTION

The vegetable *Momordica charantia* L., Cucurbitaceae, is known variously as bitter gourd, balsam pear, bitter melon, bitter cucumber and African cucumber. Although, it has many culinary uses, especially in south, southeast and east Asia, it is also grown as an ornamental and is used extensively in folk medicine (Heiser, 1979). Bittergourd fruits are a good source of carbohydrates, proteins, vitamins and minerals and have the highest nutritive value among cucurbits (Desai & Musmade, 1998; Xiang *et al.*, 2000). The fruit contains 2.1 g of protein, 1.8 mg of iron, 20 mg of calcium, 88 mg of vitamin C, 55 mg of phosphorus and 210 I.U. of vitamin A in 100 g of edible portion. Considerable variation in nutrients, including protein, carbohydrates, iron, zinc, calcium magnesium, phosphorus and ascorbic

acid, has been observed in bitter gourd (Kale *et al.*, 1991; Yuwai *et al.*, 1991). Bitter gourd has been used for centuries in the ancient traditional medicine of India, China, Africa and Latin America. Bittergourd extracts possess antioxidant, antimicrobial, antiviral, antihepatotoxic and antiulcerogenic properties while also having the ability to lower blood sugar (Welihinda *et al.*, 1986; Baynes, 1995; Chen *et al.*, 2003). Like most bitter tasting foods, bitter gourd is claimed to stimulate digestion and help treat dyspepsia, gastrointestinal diseases and constipation. Bitter melon contains a unique photo-constituent that has been confirmed to have a hypoglycemic affect called charantin. There is also insulin like compound known as polypeptide P which has been suggested as insulin replacement in some diabetic patients. Recently, the cultivation of bitter gourd has

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become increasingly popular because of the growing awareness of its anti-diabetic property and nutritive value among consumers. Due to the efforts of many vegetable breeders marked improvement in yield has been achieved and a number of varieties and hybrids have been developed.

Though, bitter gourd has a wide range of adaptability, yet it thrives best in warm humid regions. It cannot tolerate frost. Though it can be grown on all types of soils, yet well drained loam soil enrich in organic matter is best suited for cultivation

In Punjab, bitter melon (*karela*) is generally consumed cooked in the green or early yellowing stage. As Punjabi cuisine is popular for its spicy food, the *karela* here are stuffed with spices and fried in oil to truly taste good and delicious. This is popularly known as the stuffed *karela* fry. The present study has been initiated to assess and document baseline information on production, consumption and marketing systems of bitter gourd in Ludhiana Site. Specifically, the objectives of the study were (i) to estimate the costs and returns in bitter gourd production in Punjab (ii) to examine the reasons for farmers' preferences to cultivate bitter gourd crops and (iii) to analyze the consumers preferences for bitter gourd consumption and their willingness to pay for its consumption.

#### METHODOLOGY

The study contained mainly two components: Farmer survey and Consumer survey. For Farmer survey, the study was conducted in Ludhiana and one of its neighbouring district Sangrur in the state of Punjab. Based on the concentration of bitter gourd production, four locations namely Ludhiana city, Samrala and Jagraon were selected from Ludhiana and Malerkotla from Sangrur district for comprehensive survey. Since, the bitter gourd producers were scattered, 14 villages (8 from Ludhiana + 6 from Sangrur) were surveyed. The study has been based on a total sample of 53 bitter gourd producers (30 from Ludhiana + 23 from Sangrur). BG, being minor crop, acreage information was not properly documented. Therefore, the vegetable scientists of State Agricultural University working at sample district headquarters and extension functionaries of the University as well as State Horticulture/Agriculture department were consulted to pinpoint the various locations where BG are grown commercially. In those villages/locations, list of BG growers were prepared in consultation with few commission agents in vegetable markets, retail BG sellers in the area through whom sales were transacted as well as other local key persons. To accomplish the well-defined objectives, the required information pertaining to characteristics of bitter gourd growers, farming systems, cultivation practices along with cost and benefit of bitter gourd production, etc. was collected from these 53 bitter gourd producers.

To understand the consumption pattern of bitter gourd, bitter gourd trait preferences and consumers'

willingness to pay for functional properties of bitter gourd etc, consumer survey was conducted in urban, peri-urban and rural areas of Ludhiana. The total sample of 400 consumers included 66 from rural (Baddowal, Jodhan and Dhakha), 63 from peri-urban (Jagraon and Samrala) and 271 from urban areas of Ludhiana city. Gender-wise distribution of the surveyed consumers according to the location of the study areas has been explained in Table 1.

The information was collected through the personal interview method using the especially designed schedules for the purposes. The comprehensive surveys were conducted during year 2012. Tabular analysis and simple statistical tools such as average, percentage and ranking, etc. were used for the interpretation of the results.

**Table 1: Distribution of the sample consumers according to the location/ gender**

Gender	Rural	Peri-urban	Urban	Total
Male	33	16	69	118
Female	33	47	202	282
Total	66	63	271	400

#### RESULTS AND DISCUSSION

The Agro-Socio- Economic profile of the sampled respondent farmers with respect to their age, family size, land holding and experience in vegetable cultivation (years) is presented in Table 2.

The overall average age of the respondents was 46.7 ± 8.5 years Family size is an important demographic parameter. The average family size of the sampled respondents in Punjab comprised of 6.5 members out of whom 4.8 members were above 18 years, 1.2 members were between 5 to 8 years and 0.5 members were of less than five year. The average experience of the respondents in vegetable cultivation in Punjab was of 19.7 years while they had the experience of 12.3 years in bitter guard cultivation. Land is the main resource base of the farmers in the production process. The economic and social progress of the households largely depends upon the size

**Table 2: Agro-Socio-Economic characteristics of the sample respondents**

Particulars	Total No. of respondents (N=53)	
	Mean	SD
Age of respondent (years)	46.7	8.5
Family size (number)	6.5	1.8
Experience in vegetable cultivation (years)	19.7	8.2
Experience in BG cultivation (years)	12.3	5.3
Owned land (ha)	1.9	2.1
Leased in land (ha)	0.9	1.4
Operational holding (ha)	2.8	1.8
Area under vegetables (ha)	1.3	0.7
Area under bitter gourd (ha)	0.33	0.3

of operational holdings. The average size of operational holding of the respondents in Punjab was 2.8 hectares. The average area under vegetables was 1.3 hectares while the area under bitter gourd was 0.33 hectares.

The perusal of Table 3 reveals that 90.6 percent of the respondent farmers under took the production of bitter gourd at small scale. Only 9.4 percent were engaged in large scale production of bitter gourd. Majority of the respondents (75.5per cent) adopted pandal method of cultivation in case of bitter gourd cultivation while 13.2 and 11.3 percent of the farmers used floor type and ridge furrow method for cultivation. The results also revealed that 72 percent of the respondents cultivated bitter gourd only for market. Only 28 percent of the respondents cultivated bitter gourd both for home as well as for sale in market. Hybrid (*Prachi*) variety of bitter gourd was used

**Table 3: Indicators related to production and marketing of bitter gourd in the study area, Punjab**

Particulars	Total No. of respondents (N=53)	
	N	per cent
<b>Level of production</b>		
Small scale	48	90.6
Large scale	5	9.4
<b>Cultivation type</b>		
Floor type	7	13.2
Ridge furrow	6	11.3
Pandal	40	75.5
<b>Bitter gourd variety used</b>		
Amarshri	1	2
Prachi	41	77
BNR 32	6	11
US AGRI	4	8
HN-13	1	2
<b>Variety type</b>		
Light green, medium size	35	66.0
Dark green, medium size	5	9.4
Dark green, large size	13	24.5
<b>Cultivated period</b>		
March - August	24	45
May - October	6	11
Nov - April	23	43
<b>Cultivation purpose</b>		
For market	38	72
Both home and for market sale	15	28
<b>Grading characteristics based on</b>		
Size	53	100
Form of the fruit surface	-	-
<b>Marketing outlet</b>		
Wholesaler	23	43
Retailer	18	34
Direct selling	12	23

by 77 percent of the respondents. Besides, other varieties namely, BNR 32 and US AGRI,HN-13,HN-13were used by other respondents. Majority of respondents (66per cent) in Punjab produced light green medium size variety of bitter gourd. The reason for its adoption having high yielding characteristic andit was preferred by consumers. In Punjab, 45 percent of the respondents cultivated bitter gourd during March-August. While 43and 11percent of the farmers cultivated bitter gourd during November-April and May-October, respectively. It was noticed that grading of the produce was done by all the sampled respondents and the produce was graded on the basis of size of the produce not on the basis of form of the fruit surface. The respondent farmers used different marketing outlets for marketing of their produce. On the whole, majority of the respondents (43per cent) marketed their produce to the wholesalers whereas selling to retailers and direct selling to consumers was preferred by 34 and 23 percent of the respondents. Therefore, marketing of the produce to wholesalers was the most preferred marketing outlet of majority of the respondents in Punjab.

**Labour utilization for various operations**

The operation wise labour requirements/utilization for bitter gourd cultivation was estimated and depicted in Table 4 which shows that from nursery raising till transportation of the produce, labour was used for 133.79 days out of which family labour was used for 57.2 days. For raising of nursery, labour was used for 1.08 days. For other activities like leveling, preparation of beds, sowing, fertilization, pesticides application labour was used for 0.57, 0.66, 15.67, 3.95, 5.73 days respectively. Harvesting required more labour days (45.66 days) and more of family members were found involved for harvesting (34.58 days). The next important activity where labour was used for more number of days (17.95 days) was

**Table 4: Operation-wise labor use pattern in bitter gourd production in the study area, Punjab**

Activity	(Labour days)		
	Family	Hired	Total
Nursary raising	-	1.08	1.08
Ploughing	0.48	0.40	0.88
Levelling	0.43	0.14	0.57
Preparation of beds	0.50	0.16	0.66
Sowing	6.24	9.44	15.67
Fertilization	1.41	2.54	3.95
Pesticide application	2.24	3.49	5.73
Weeding and cleaning	7.22	10.72	17.95
Setting up of pandals	5.99	10.54	16.53
Irrigation	6.12	3.35	9.47
Harvest	11.08	34.58	45.66
Sorting and grading	6.43	0.11	6.54
Marketing	5.43	0.05	5.48
Transportation	3.62	0.00	3.62
Total labour days	57.20	76.59	133.79

weeding and cleaning followed by setting of *pandals* (16.53 days). For other activities such as irrigation sorting and grading marketing and transportation, on an average, labour was used for 9.47, 6.54, 5.48, and 3.62 days respectively and more of hired labour were used for performing all these activities.

**Fixed and variable costs in bitter gourd production:**

The total fixed cost in the production of bitter gourd were estimated and are presented in Table 5. The total fixed cost per hectare in bitter gourd production were estimated to be ₹58022 Land rent contributed a lion's share of total fixed cost. On an average, land rent was estimated to be ₹54269 per hectare. The next higher component of fixed cost was the depreciation on *pandals* which came out to be ₹2575 per hectare. The depreciation cost on sprayers was ₹62 per hectare.

The variable input cost presented in Table 5 shows that the per hectare total variable cost in the production of bitter gourd came out to be ₹68535. The expenses on seeds/seedlings were found to be ₹17333 per hectare and it was the most important component of variable cost. Expenses on fuel/maintenance, insecticides, organic/inorganic fertilizer were the other important components of variable cost. The total labour cost for accomplishing all the activities came out to be ₹23612 per ha. Of which the hired labour cost and family labour was

**Table 5: Fixed and Variable input costs in bitter gourd production in the study area, Punjab**

Particulars	Total (N=53)
<b>A. Fixed Cost</b>	
i. Land rent	54269
ii. Irrigation pump	1116
iii. Sprayers	62
iv. Pandal	2575
Total Fixed cost	58022
<b>B. Variable input cost</b>	
i. Seeds/seedlings	17333
ii. Organic fertilizer	3013
iii. Inorganic fertilizer	4545
iv. Insecticide	5958
v. Fungicide	1357
vi. Herbicide	34
vii. Pump fuel/maintenance	7920
viii. Harvest	0
ix. Package	616
x. Commission	0
xi. Total labor cost	23612
a. Hired labor cost	14158
b. Family labor cost	9454
xii. Other (Machine labour)	4147
Total variable cost	68535

*Depreciation cost of equipments (pandal, irrigation pump, drip system, sprayers) is estimated for a crop season*

estimated to be ₹14158 and ₹9454 respectively.

**Returns from bitter gourd production:**

Returns from bitter gourd production presented in Table 6 brings out that the gross returns per hectare from bitter gourd production were estimated to be ₹365370 as against the total cost of ₹126557 per hectare. The net returns for bitter gourd cultivation turned out to be ₹238814 per hectare. Per kg total cost of output came out to be ₹5.98 and the profit margin was estimated to be 65.57 percent.

**Table 6: Net return and profit per ha from bitter gourd production in study area, Punjab**

Particulars	Total (N=53)
<b>Returns</b>	
1. Yield (kg/ha)	21151
2. Average price (₹/kg)	17
3. Gross revenues (₹/ha)	365370
<b>Costs (₹/ha)</b>	
4. Variable input cost	44923
5. Total fixed costs	58022
6. Hired labor cost	14158
7. Total labor cost	23612
8. Total cash costs [4+5+6]	117103
9. Total costs [4+5+7]	126557
<b>Profits (₹/ha)</b>	
10. Net returns to family labor [3-8]	248268
11. Real profit [3-9]	238814
<b>Profitability indicators</b>	
12. Total cost/kg of output (₹) [9/1]	5.98
13. Profit margin (₹) [2-12]	11.40
14. Profit margin (per cent) [13/2*100]	65.57

**Reasons for farmers' preference to grow bitter gourd crop**

Majority of the sampled respondents grew bitter gourd crop as they got high price. Being fitted in to their cropping pattern, traditional trend well adapted to climate, etc. were the other reasons for bitter gourd cultivation (Table 7).

**Table 7: Reasons to grow bitter gourd by the sample respondent farmers in study areas, Punjab (Multiple response)**

Reasons	Total (N=53)
High price	16
More profitable	16
Good experience	10
Want to earn more income	11
Fitted to cropping system	6
Traditional trend	5
Well-adopted to climate	2

**Consumption of Bitter gourd**

The preferences of the consumers regarding the consumption of bitter gourd were studied to know how much a respondent preferred bitter gourd. Bitter guard is considered as the most bitter among all the vegetables and consumers generally prefer it despite its bitterness as it is regarded as beneficial for health.

**Preferences of the consumers for the functional properties of bitter gourd**

Bitter gourd has been used for centuries in the ancient traditional medicine of India, China, Africa and Latin America. Bitter gourd extracts possess antioxidant and anti-microbial, antiviral properties having the ability to lower blood sugar. It helps purify blood tissue, enhances digestion and stimulates liver. It was found that 98 percent of the respondents seemed to be aware of all such health benefits. None of the respondents were found who did not have any idea about the benefits of bitter gourd. More over rural and urban consumers were found to have more consciousness regarding the benefits of bitter gourd

consumption (Table 8).

Majority of respondents (97.8 per cent) seemed to associate bitter gourd for its property to manage blood glucose level in the body while 28 and 18 percent of the consumer consumed bitter gourd for gastro intestinal ailments and taking care of eyes and skin respectively (Table 9). It was found that 98.5, 92.1 and 98.9 percent of the rural, peri-urban and urban consumers preferred to consume bitter gourd for managing blood glucose level.

Respondents were asked whether they or their family members were having any of disorders i.e. diabetes, hypertension or obesity. Nearly half of the respondents (50.8per cent) reported to be affected from such disorders (Table 10). The respondents affected from diabetes were found more in rural (83.3 per cent) areas followed by peri-urban (81.3per cent) and urban areas (79.1 per cent). Thus, it was found that the consumers in the study area were suffering from one of the illness or the other.

Majority of the respondents (95.5 per cent) preferred

**Table 8: Location-wise awareness about health promoting properties of bitter gourd among sample respondents, Punjab**

Functional property	Rural		Peri-urban		Urban		Total	
	N	Per cent	N	Per cent	N	Per cent	N	Per cent
Awareness about health benefits	65	98.5	61	96.8	266	98.2	392	98.0
Somewhat heard about it	1	1.5	2	3.2	5	1.8	8	2.0
No	0	0.0	0	0.0	0	0.0	0	0.0
Total	66	100.0	63	100.0	271	100.0	400	100.0

**Table 9: Location-wise benefits of bitter gourd enlisted by the sample respondents, Punjab**

Benefits	Rural		Peri-urban		Urban		Total	
	N	Per cent	N	Per cent	N	Per cent	N	Per cent
Better nutrition and fiber	3	4.5	5	7.9	7	2.6	15	3.8
Blood glucose management	65	98.5	58	92.1	268	98.9	391	97.8
Body fat and weight control	8	12.1	10	15.9	30	11.1	48	12.0
Cardiovascular health care	6	9.1	3	4.8	3	1.1	12	3.0
Detoxification	12	18.2	3	4.8	46	17.0	61	15.3
Enhance immunity	10	15.2	8	12.7	28	10.3	46	11.5
Eye and skin care	9	13.6	21	33.3	44	16.2	74	18.5
Gastro-intestinal care	12	18.2	20	31.7	80	29.5	112	28.0
General health	12	18.2	11	17.5	48	17.7	71	17.8
Total	66	100.0	63	100.0	271	100.0	400	100.0

**Table 10: Location-wise details about diseases reported by the sample respondents, Punjab**

Benefits	Rural		Peri-urban		Urban		Total	
	N	Per cent	N	Per cent	N	Per cent	N	Per cent
Diabetes	30	83.3	26	81.3	106	79.1	162	80.2
Hypertension	6	16.7	7	21.9	26	19.4	39	19.3
Obesity	6	16.7	8	25.0	28	20.9	42	20.8
Total	36	100.0	32	100.0	134	100.0	202	100.0

**Table 11: Location-wise preferences among vegetable bitter gourd and processed bitter gourd products if both contain the same amount of bioactive compounds by the sample respondents, Punjab**

Benefits	Rural		Peri-urban		Urban		Total	
	N	Per cent	N	Per cent	N	Per cent	N	Per cent
Bitter gourd vegetable	60	90.9	62	98.4	260	95.9	382	95.5
Processed products of bitter gourd	0	0.0	0	0.0	2	0.7	2	0.5
Both	6	9.1	1	1.6	9	3.3	16	4.0
Total	66	100.0	63	100.0	271	100.0	400	100.0

**Table 12: Location-wise willingness to pay for a new bitter gourd variety with higher properties that lowers blood glucose or lowers 3-high (blood glucose, blood pressure and cholesterol) by sample respondents, Punjab**

Particulars	Rural			Peri-urban			Urban			Total		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
WTP lowering blood glucose (per cent)	66	65.91	29.44	63	74.34	24.29	271	77.61	22.43	400	75.17	24.33
WTP lowering 3-high (per cent)	66	84.09	40.87	63	88.36	29.43	271	91.57	29.39	400	89.83	31.61

**Table 13: Location-wise consumers willing to pay premium for a new bitter gourd variety with higher properties that lowers blood glucose or lowers 3-high (blood glucose, blood pressure and cholesterol) by sample respondents, Punjab**

Particulars	Rural		Peri-urban		Urban		Total	
	N	Per cent	N	Per cent	N	Per cent	N	Per cent
<b>Level of premium (₹/kg) willing to pay for lowering blood glucose</b>								
No more than the current price	1	1.5	0	0.0	0	0.0	1	0.3
+ 5	5	7.6	0	0.0	2	0.7	7	1.8
+ 10	12	18.2	6	9.5	20	7.4	38	9.5
+ 15	9	13.6	18	28.6	43	15.9	70	17.5
+ 20	7	10.6	2	3.2	38	14.0	47	11.8
+ 25	16	24.2	15	23.8	69	25.5	100	25.0
+ 30	15	22.7	22	34.9	99	36.5	136	34.0
+ above30	1	1.5	0	0.0	0	0.0	1	0.3
Total	66	100.0	63	100.0	271	100.0	400	100.0
<b>Level of premium (₹/kg)willing to pay for lowering 3-high(blood glucose, blood pressure and cholesterol)</b>								
No more than the current price	0	0.0	0	0.0	0	0.0	0	0.0
+ 5	4	6.1	0	0.0	2	0.7	6	1.5
+ 10	8	12.1	2	3.2	16	5.9	26	6.5
+ 15	10	15.2	13	20.6	16	5.9	39	9.8
+ 20	7	10.6	9	14.3	50	18.5	66	16.5
+ 25	7	10.6	4	6.3	38	14.0	49	12.3
+ 30	10	15.2	15	23.8	63	23.2	88	22.0
+ 35	7	10.6	15	23.8	57	21.0	79	19.8
+ 40	8	12.1	5	7.9	25	9.2	38	9.5
+ 45	3	4.5	0	0.0	0	0.0	3	0.8
+ 50	2	3.0	0	0.0	4	1.5	6	1.5
+ above 50	0	0.0	0	0.0	0	0.0	0	0.0
Total	66	100.0	63	100.0	271	100.0	400	100.0

to have bitter gourd as vegetable and only 0.7 percent of the urban consumers showed their preference for processed products of bitter gourd when they were asked if they would prefer vegetable bitter gourd or processed bitter gourd which contain same amount of bioactive compounds (Table 11).

#### Consumers' Willingness to Pay

Bitter melon contains a unique phyto-constituent that has been confirmed to have a hypoglycemic effect called charantin. Among all the anti-diabetic property and the property of reducing hypertension and cholesterol were considered under this willingness to pay (WTP) study. It was seen whether the consumers were ready to dole out more of if any of these properties get enhanced. The results regarding the willingness of the respondents to pay more keeping in view their medicinal value is presented in Table 12. In all, 89.83 percent consumers wanted to pay more if it lowers all the three high while more of the urban consumers (91.57 per cent) showed their willingness to pay more for all the three properties of bitter gourd.

#### Level of premium willing to pay

Location-wise consumers' willing to pay premium for a new bitter gourd variety with higher properties that lowers blood glucose or lowers 3-high (blood glucose, blood pressure and cholesterol) by sample respondents is presented in Table 13. It was found that 34 percent of the consumers were ready to dole out additional ₹30 per kg for the enhanced quality of reducing the blood glucose level. Only rural consumers were ready to pay more above ₹30 per kg while none of the peri-urban and urban consumer wanted to shed more of ₹30 for getting enhanced quality of reducing glucose level. The respondent consumers (28.6 per cent) in peri-urban areas were ready to part with extra fifteen rupees per kg, while 15.9 percent and 13.6 percent of the urban and rural consumers respectively were ready to pay 15 rupees more for having enhanced quality of bitter gourd. Twenty two percent of the respondents were willing to pay additional ₹30 per kg for having all (blood glucose, blood pressure and cholesterol) the properties of bitter gourd. None of the consumer whether belonging to rural, peri-urban or urban areas were willing to pay extra of ₹50 per kg for bitter gourd.

#### CONCLUSIONS & POLICY IMPLICATIONS

The results from the consumers' survey brought out that majority of the consumers showed their preference for vegetarian food and respondents liked bitter gourd very much for its health benefits. Bitter gourd extracts possess antioxidant and anti-microbial, antiviral properties having the ability to lower blood sugar.

Majority of the respondents seemed to be aware of all such health benefits. Thus, it was found that the consumers in the study area were suffering from one of the illness or the other. Majority of the respondents preferred to have bitter gourd as vegetable, only few urban consumers showed their preference for processed products of bitter gourd. Majority of the consumers were ready to dole out additional rupees per kg for the enhanced quality of reducing the blood glucose level and for having all the properties of bitter gourd

Bitter gourd consumption is beneficial to health as the farmers in Punjab revealed that they grew this crop due to its property of managing blood glucose level and they got high price. Being fitted in to their cropping pattern, traditional trend well adapted to climate, etc were the other reasons for bitter gourd cultivation in Punjab. The farmers have been fetching good prices for bitter gourd crop because of increased demand due to its functional properties. Provisions for distant supply of the produce would further increase the prices available to the farmers. Thus, there is enough scope for the farmers to earn more profit with the increased demand of bitter gourd due to its health benefits.

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## **Growth, Instability and Resource Use Efficiency of Jowar-Random Effects Approach**

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### **ABSTRACT**

*In India, agriculture sector continued to play an important role in the economy by providing livelihood for nearly two third of population. Jowar is one of the rainfed crop which can be grown both kharif and rabi seasons. The present study was conducted on time series data of jowar area, production and yield from the period 1950-51 to 2014-15 and panel data for a period of 1997-2014. The study particularly aims at examining the growth and instability of area, production and yield of jowar crop in India and resource use efficiency of Jowar in India. The trend lines show a percentage decrease in both area and production but productivity was slightly increasing. The growth rates in area, production and yield was calculated using compound growth rates. Panel data analysis random effects in the jowar data (1997-2014) and its Resource use efficiency indicates decreasing returns to scale.*

### **Keywords**

CAGR, growth, instability analysis, panel data analysis

### **JEL Codes**

E23, Q10, Q11, Q18

### **INTRODUCTION**

Sorghum comprises a group of annual grasses, found mainly in arid and semi-arid regions of the world. These grasses produce small seeded grains and are often cultivated as cereals. They are widely grown in Africa, Asia, China, and the Russian Federation (FAO, 1995), and can be used as either grain or forage. They are resistant to drought have a short duration and it can grow on all type of soils. Cultivation of sorghum probably originated in East Central Africa, in or near Ethiopia or Sudan because of the great diversity of types growing in that region. Sorghum rank fifth among the world's most important crops. More than 70 per cent of the world's total production of sorghum comes from the developing countries in Asia and Africa, where crop is grown with limited water and nutrients. It is one of the most nutritious cereals and is an important dry-land crop grown in poor and marginal lands with minimum inputs. In India, sorghum is cultivated during both kharif and rabi seasons mainly as a rain-fed crop (92 per cent of the area) with about 85 per cent of the production concentrated in Maharashtra, Karnataka and Andhra Pradesh (directorate of millets development, Jaipur). Sorghum contains 10.4

gm of protein and 72.6 gm of carbohydrate and it contain many micro nutrients for every 100 gm (NIN, Hyderabad).

Instability is one of the important decision parameters in development dynamics, more so in the context of agricultural production. Wide fluctuations in crop output not only affect prices and bring about sharp fluctuations in them but also results in wide variations in the disposable income of the farmers. The magnitude of fluctuations depends on the nature of production technology, its sensitivity to weather, economic environment, availability of material inputs and many other factors. High growth in production accompanied by low level of instability for any crop is desired for sustainable development of agriculture (Tripathi & Prasad, 2009). Post green revolution-area of rice, wheat and other commercial has been increased, in this regard I have taken up study to analyse its impact on jowar with these following specific objectives:

- i. To study the growth and instability of Jowar in India
- ii. To study the resource use efficiency of Jowar in India

### **METHODOLOGY**

**Data Sources:** The study was based on secondary data,

17 years panel data (1997-2014-14) collected from cost of cultivation scheme. Area, production and productivity data for a period of 1950-2014 were tapped from ww.indiastat.com and other statistical sources.

**Analytical tools**

To analyse growth and instability compound annual growth rate (CAGR) and Cuddy Della Valle Index were used. The growth rates of area, production and yield of millets were estimated using the formula:  $Y_t = AB^t e^t$ ,  $Y_t$  is the variable for which growth is calculated at  $t^{th}$  period,  $t$  is the time variable,  $A$  is constant,  $B$  is  $(1+r)$ ,  $r$  is compound growth rate and  $e$  is the error term.

The simple coefficient of variation overestimates the level of instability in time-series data characterized by long term trends whereas the Cuddy-Della Valle index corrects the coefficient of variation.

$$\text{Cuddy-Della Valle index} = C.V. * (1 - R^2)^{0.5}$$

Where C.V. = Coefficient of Variation,  $R^2 = \text{ESS/TSS}$ , that is, ratio of explained variation to total variation, ESS = Variation explained by explanatory variable, TSS = Total Variation. Variation can be measured by C.V. But due to presences of trend with variation in production with passes of time. Here C.V. adjusts with  $R^2$  to de-trend the production series, because it is statistically sound. The present study divides the CDI value into three categories, which represent the different range of instability.

**Panel Data Analysis**

**Fixed Effect versus Random Effect Models**

Panel data models examine fixed and/or random effects of entity (individual or subject) or time. The core difference between fixed and random effect models lies in the role of dummy variables. If dummies are considered as a part of the intercept, this is a fixed effect model. In a random effect model, the dummies act as an error term. A fixed group effect model examines group differences in intercepts, assuming the same slopes and constant variance across entities or subjects. Since a group (individual specific) effect is time invariant and considered a part of the intercept,  $u_i$  is allowed to be correlated to other regressors. Fixed effect models use least squares dummy variable (LSDV) and within effect estimation methods. Ordinary least squares (OLS) regressions with dummies, in fact, are fixed effect models.

Fixed Effect Functional form

$$y_{it} = (\alpha + \mu_i) + X'_{it} \beta + v_{it}$$

Fixed effects are tested by the (incremental) F test, while random effects are examined by the Lagrange Multiplier (LM) test (Breusch & Pagan, 1980). If the null hypothesis is not rejected, the pooled OLS regression is favoured. The Hausman specification test (Hausman, 1978) compares fixed effect and random effect models. If the null hypothesis that the individual effects are uncorrelated with the other regressors in the model is not rejected, a random effect model is better than its fixed

counterpart. If one cross-sectional or time-series variable is considered (e.g., country, firm, and race), this is called a one-way fixed or random effect model. Two-way effect models have two sets of dummy variables for group and/or time variables (state and year).

**RESULTS AND DISCUSSION**

**Decadal Growth and Instability in Area, Production, and Yield of Jowar in India**

It is evident from Figure 1 that decadal growth rate of Jowar area is decreasing from 1950-2014 and its negative pace increased after the green revolution due to the introduction of high yielding varieties in rice, wheat and other commercial crops and most of the public investment went to commercial crops. The instability index of area is increasing due to fact that most of the Jowar area is under

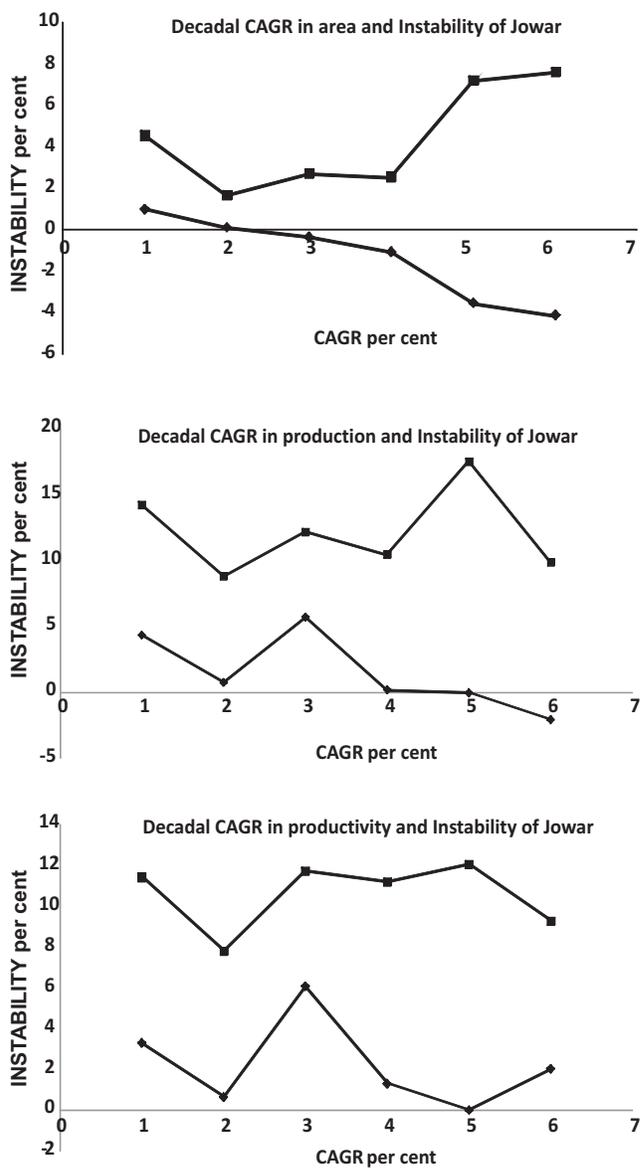


Figure 1: Decadal growth and instability in area, production, and yield of jowar in India

rain fed conditions and grown on the marginal lands. Decadal growth of production and yield were found to be decreasing gradually from 1950-2014. The highest production instability was in 2000-2014. Detailed estimates are given in Table 1 and 2.

**Table 1: Decadal CAGR in area, production, and yield of Jowar in India**

Year	(Per cent)		
	Area	Production	Productivity
1950-1960	1.005017	4.318653	3.27137
1960-1970	0.124077	0.746875	0.612468
1970-1980	-0.34241	5.672024	6.045706
1980-1990	-1.07122	0.186474	1.266959
1990-2000	-3.53404	-0.03154	-0.03154
2000-2014	-4.132	-2.06	1.999

**Table 2: Instability in area, production, and yield of jowar in India**

Year	(Per cent)		
	Area	Production	Productivity
1950-60	4.546742	14.18796	11.41495
1960-70	1.665242	8.798129	7.789955
1970-80	2.715225	12.15297	11.71764
1980-90	2.548383	10.43393	11.20517
1990-2000	7.192331	17.48541	12.04928
2000-2014	7.605789	9.833866	9.252284

**Estimates of resource use efficiency of jowar –A panel data analysis (1997-2014)**

Table 3 Indicates Hausman test for random effects, here the P value is insignificant (0.171) indicates that there are no fixed effects in the data i.e. there are no major breakthrough innovations or investments have come to the Jowar production, so analysed for the random effects in Jowar over the years.

From the regression analysis in the Table 4, the partial elasticities: seed (0.053), fertilizer (0.0319), human

**Table 3: Hausman test for random effects**

DF	m Value	Pr>m
7	10.31	0.1715

labour (0.0197), animal labour (0.007), machine labour (0.0009), insecticide (0.0145), manure (-0.0158) of the various variables indicated decreasing returns to scale, and the total elasticity (sum of the partial elasticities) also showed decreasing returns to scale. The result of the estimate showed that Human Labour and Insecticide were significant at one per cent, and machine labour and fertilizer was significant at 5 per cent. This implies that these variables are the major contributors of the 61.92per cent (R<sup>2</sup>) variations in the dependent variable.

**CONCLUSIONS**

From the above discussion it has been clear that area, production and yield of jowar is decreasing over the years and instability also following same trend, it makes the farmers difficult to predict yield and prices, The regression results showed that the farmers were in the second stage of production; that is, decreasing returns to scale (using the elasticities). There is a possibility of increasing the usage of fertilizer, human labour, machine labour and insecticide.

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**Table 4: Panel data analysis for random effects in Jowar**

Variable	DF	Estimate	Standard error	t-value	Pr>t
Intercept	1	-1.866	2.059	-0.91	0.36
Seed	1	0.053	0.055	0.96	0.34
Fertilizer	1	0.0319	0.016	1.92	0.058
Human Labour	1	0.0197	0.004	4.85	<0.0001
Animal Labour	1	0.007	0.018	0.39	0.695
Machine Labour	1	0.0009	0.0004	2.03	0.045
Insecticide	1	0.0145	0.0031	4.65	<0.0001
Manure	1	-0.0158	0.053	-0.3	0.7675



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## Growth and Instability of Rice Production in India

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### ABSTRACT

The study was conducted to know growth and instability of rice in area, production, and productivity in India, Karnataka and Telanagana state. The secondary data were collected from 1971 to 2015 and sub divided into different sub periods. The compound growth rate and Cuddy-Della Valle index is used to assess the growth and instability respectively. The study indicates that the positive growth in area and production in all periods at national level but Period-IV shows negative growth in production of rice. The study also revealed that marginally highest instability was observed in Period-IV for area (3.36 per cent) and production (31.90 per cent) at national level.

### Keywords

Cuddy-Della Valle index, growth rate, instability, rice India

### JEL Codes

Q00, Q10, Q19

### INTRODUCTION

Rice is the staple food of more than half of the world's population. Among the rice growing countries, India has the largest area (44 million hectares) and it is the second largest producer (131 million tonnes) of rice next to China (197 million tonnes). The rice productivity in India is 3.37 tonne per ha while the world average is 4.25 tonne per ha (IRRI, 2011). At the current population growth rate (1.5 per cent), the rice requirement of India by the year 2025 would be around 125 million tonnes. To meet the food requirement of the growing population, the rice production has to be enhanced with good management practices with shrinking availability of land and water resources condition. Rice provides about 700 calories day-1person-1 for about 3000 million people living mostly in developing countries (Anonymous, 2014)

The scope for expanding rice production lies in enhancing productivity. Several studies have indicated that the adoption of recommended rice technology gives high yields and income to the farmers (Singh *et al.*, 2014). The instability in production of rice will lead to wide fluctuation in prices of crop in markets. Apart from increasing the overall total production, stability in production over period of time is equally important in planning for agricultural development in any area (Singh

*et al.*, 2014). The area, production and productivity of rice is fluctuating the over period of time due to various factors.

Based on above background, the present study was conducted to know the growth and instability of rice in area, production and productivity in India.

### METHODOLOGY

The secondary data on area, production and productivity of rice was taken from various sources like Directorate of Economics and Statistics office of respective states. The 45 years data of area, production and productivity of rice were collected from the period of 1971-2015 from India stat and other statistical sources. The period has been sub divided into five periods like 1971-80 (Period-I), 1981-90 (Period-II), 1991-00 (Period-III), 2001-10 (Period-IV) and 2011-15 (Period-V)

#### Analytical tools

To analyse growth and instability compound annual growth rate(CAGR) and cuddy Della Valle Index were used. The growth rates of area, production and yield of rice were estimated using the formula:

$$Y_t = AB^t e$$

$Y_t$  is the variable for which growth is calculated at  $t$  th period,  $t$  is the time variable,

A is constant,

B is  $(1+r)$ , 'r' is compound growth rate and 'e' is the error term.

The simple coefficient of variation overestimates the level of instability in time-series data characterized by long term trends whereas the Cuddy-Della Valle index corrects the coefficient of variation.

$$\text{Cuddy-Della Valle index} = C.V. * (1 - R^2)^{0.5}$$

Where C.V. = Coefficient of Variation,

$R^2 = \text{ESS/TSS}$  i.e. ratio of explained variation to total variation,

ESS = Variation explained by explanatory variable,

TSS = Total Variation. Variation can be measured by C.V. But due to presences of trend with variation in production with passes of time. Here C.V. adjusts with  $R^2$  to de-trend the production series, because it is statistically sound. The present study divides the CDI value into five periods, which represent the different range of instability

## RESULTS AND DISCUSSION

### Growth in Area, Production and Productivity of Rice in India:

The growth rate in area, production and productivity for India is presented in Table 1. The results shows that during the decade 1971-80, there was on an average 0.9 percent increase in growth rate in area per annum and during the decade 2001-10, there was on an average 0.10 percent increase in growth rate in area per annum. In production, during the decade 1981-90, there was on an average 4.18 percent increase in growth rate in production per annum and during the decade 2001-10, there was on an average 4.10 percent decrease in growth rate in production per annum. During the decade 1971-80, there was on an average 11.4 per cent increase in growth rate in productivity per annum and during the period 2011-14, there was on an average 0.20 per cent decrease in growth rate in productivity per annum. It indicates that area under rice decreased for Period-I and II in Karnataka.

### Growth in Area, Production and Productivity of Rice in Karnataka and Telangana

The perusal of Table 1 also indicates growth in area, production and productivity of Karnataka and Telangana state. the results indicates that during the decade 1991-00, there was on an average 1.67 per cent increase in growth rate in area per annum and during the period 2011-15,

there was on an average 3.48 per cent decrease in growth rate in area per annum. During the decade 1991-00, there was on an average 3.57 per cent increase in growth rate in production per annum and during the period 2011-15, there was on an average 4.47 per cent annual decrease in production. During the decade 1991-00, there was on an average 1.87 per cent increase in growth rate in productivity per annum and during the period 2011-15, there was on an average 0.83 per cent decrease in growth rate in productivity per annum.

In Telangana state, there was on an average 6.34 per cent increase in growth rate in area per annum during Period-I and during the period 2011-15, there was on an average 3.44 per cent decrease in growth rate in area per annum. The growth in area and production decreased during the Period-IV. It indicates that growth in productivity was increased for all study periods in Telangana state.

### Instability in Area, Production and Productivity of Rice

The Cuddy-Della Valle index is used to estimate the instability in area, production and productivity of rice crop in India, Karnataka and Telangana state and the results are presented in Table 2. The result revealed that Period-IV in India had marginally highest instability in area (3.36 per cent) and production (31.90 per cent) followed by Period-II in area and Period-I in production. The lowest instability was marginally observed in Period-III for area and Period-IV for both production and productivity. It indicates that there is more variation in production of rice during the period of 2001 to 2010.

The results reveals that the marginally highest instability in area (8.68per cent) during Period-IV and in production (12.4 per cent) during Period-I followed by Period-I in area and Period-IV in production for Karnataka state. The lowest instability was observed during Period-III for area, production and productivity in Karnataka state. It indicates that similar pattern was observed in instability at national and Karnataka state level. In Telangana state, the marginally (Table 2) highest instability is observed in area during Period-V and in production during Period-II. The lowest instability was observed during Period III for area, Period IV for production and productivity. The

**Table 1: Growth in area, production and productivity of rice from 1971 to 2015**

Period	India			Karnataka			Telangana		
	A	B	C	A	B	C	A	B	C
I	0.90	2.5	11.4	-0.67	0.79	1.36	5.14	7.59	2.33
II	0.57	4.18	3.56	0.25	0.014	-0.24	2.71	4.55	1.79
III	0.78	1.81	1.025	1.67	3.57	1.87	3.20	5.14	1.87
IV	0.10	-4.10	1.59	1.47	2.61	0.46	6.34	9.37	2.85
V	0.36	0.18	-0.20	-3.48	-4.47	-0.83	-3.44	-2.33	1.09

Source: [www.ndiastat.com](http://www.ndiastat.com)

A-Area, B-Production and C-Productivity

**Table 2: Instability in area, production and productivity of rice from 1971 to 2015**

Period	India			Karnataka			Telangana		
	A	B	C	A	B	C	A	B	C
I	1.89	10.4	9.76	5.2	12.4	10.2	15.59	19.52	21.03
II	3.33	7.69	4.92	4.95	8.82	4.53	15.36	24.52	17.92
III	1.13	3.38	2.89	3.35	4.6	2.45	16.22	22.01	7.99
IV	3.36	31.9	5.14	8.68	12.1	8.98	17.49	23.23	9.05
V	1.68	0.69	1.63	4.6	7.1	2.54	18.04	13.96	5.625

Source: [www.indiastat.com](http://www.indiastat.com)

A-Area, B-Production and C-Yield

productivity during Period-I show highest variability in Telangana state.

### CONCLUSIONS

The instability in production of rice will lead to wide fluctuation in prices of crop in markets and market price of the crop. The study shows that growth in area and production was decreased per annum during the period 2011 to 2015 at national and Karnataka state level. The study indicates that instability in area, production and productivity was observed in all periods but less in Period V as compared to Period I. The variability of the rice

production has impact on the price of the market and which in turn leads to variation in income of the farmers.

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## Value Chain of Groundnut-An Analysis of Constraints and Opportunities Ahead

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### ABSTRACT

Groundnut is primarily a suitable crop to rabi season which has a complex value chain to understand, the study traced the value chain of groundnut realizing its importance as a primary source of oil. Recent statistics show that even at all India level only 22 per cent of area under groundnut is irrigated. The value chain defines the roles and responsibilities of each player from the producer to the consumer. There is a vast potential in catching the untapped potential of groundnut as products like edible oil, ground nut cake, raw and fried forms and even export quality peanuts. The value chain is complex and there is absence of intuitional network to from the supply of inputs particularly seed, high seed cost, development of adoptable cultivars with preferred qualities from research, marketing mechanism, low remunerative price even the MSP fixed is not sufficient to cover the cost of production. On the other side farmer is forced for distress sale, neither warehousing nor own storage space is available. A suitable mechanism of value chain comprising of quality supply of inputs, new emerging farmer producer organization and networking capabilities with processors and redefined role of marketing federations / facilitators help the starving groundnut crop in marginal lands and rejuvenating oilseed improvement programmes will help bridging the yield gaps so that the farmers become inclusive and reap the benefits of value chain.

### Keywords

Constraints, groundnut, value addition, value chain map

### JEL Codes

M31, Q10, Q11, Q13

### INTRODUCTION

India is the largest producer of oilseeds in the world and the Indian oilseed sector occupies a prime position in the agricultural economy of the country. India is the fifth largest vegetable oil producer in the world, finds its place next to USA, China, Brazil and Argentina. India accounts oil seeds account for 13 percent of gross cropped area, 3 per cent of Gross national product and 10 per cent of all agricultural commodities. India imported more than Rs 64000 crores of vegetable oils, about 14 million tonnes in 2014-15.

The Technology Mission on Oilseeds (TMO) launched in 1986 to promote cultivation of oil seeds and achieve self-sufficiency, was successful at the beginning but later due to increasing demand for edible oils the gap between supply and demand widened forcing India to become a leading importer of edible oils in the world.

India's consumption of edible oil has risen to 17.5 Mt in 2012-13. Around 5.5 Mt are imported annually, which includes about 2 Mt of soy bean oil from Argentina and Brazil, and 3.5 Mt of palm oil from Malaysia and Indonesia (Ghosh, 2009). The imports of edible oil reached to 8.67 Mt during 2010-11 and 10.5 Mt in 2012-13. Thus, edible oil imports increased from around 15 per cent of total edible oils consumption in 1995-96 to nearly 53 per cent in 2009-10 (Jha *et al.*, 2012). Consumption of edible oils touched 21.06 million tonnes in 2013-14. Groundnut covers 45 per cent of area and contributes to nearly 25 per cent of total oil seed production in the country.

The imports of edible oils have been on rising trend. The major factors responsible for the high imports of edible oil in India is due to high consumption, increase in per capita income and population, change in tastes and

preferences, low productivity and lack technological breakthrough in production of these commodities and heavy dependence on the few trade partners. One of the major concerns is more than two thirds of net sown area under oil seed crops is under rainfed conditions.

**Table 1: Share of edible oils in total agricultural imports**

Year	Edible oils (per cent)
2004-05	48.56
2009-10	44.49
2014-15	55.12

Source: Department of Commerce, Government of India, New Delhi

It is evident from Table 2 that oilseeds of groundnut and oil production have not shown any big dent in terms of its influence on oil seed sector except in 2013-14. Despite the premier position country holds in the global oilseed scenario, the actual productivity of oilseeds is very low, 1.18 t ha<sup>-1</sup> (Jha *et al.*, 2012). The consumption and net availability of edible oils gap has been increasing throwing a challenge to the stake holders of groundnut has lead this study to be taken up.

However, all India groundnut area, production and yield was 4.68 million hectares, 6.56 million tones and 1400kg/ha during 2014-15. The yield has been fluctuating due to adverse climatic conditions. Groundnut is grown in Andhra Pradesh, Gujarat, Maharashtra, Karnataka and Tamil Nadu. Soybean is grown in Madhya Pradesh, Maharashtra, Rajasthan and Andhra Pradesh. Rapeseed and mustard is cultivated in Rajasthan, Madhya Pradesh, Haryana and Uttar Pradesh and Sunflower is cultivated in Karnataka, Andhra Pradesh, Maharashtra, Orissa and Bihar.

### Groundnut in Andhra Pradesh

It can be observed that the groundnut crop recorded a significant decline in area and production during the period 2005-2006 to 2011-12. The yields obtained by groundnut crop during rabi were better than all India average as shown in Table 3.

It could be noted that although there is decrease in the area over the period from 2005-06 to 2011-12 striking fluctuations in production are noted, as it has increased to 2036 ('000 t) in 2007-08 and again decreased consistently up to 2009-10. Although there is increase in production from 2009-10 (389'000t) to 2010-11(888'000 t) the production again showed a drastic decrease to 382 ('000t) in 2011-12. Whereas, in rabi groundnut are examined it is evident that although there is slight decline in the area cultivated during the period 2005-06 (261'000 ha) to 2011-12 (250'000 ha) there is slight increase in production from (454'000 t) 2005-06 to (462'000 t) in 2011-12.

As the groundnut has production constraints, marketing problems that can be studied comprehensively by a value chain study in Ananthpur district of combined Andhra Pradesh.

### METHODOLOGY

The study was initiated to map the value chain of

groundnut for which drought prone district Anantapur of Andhra Pradesh was purposively selected. In this district, the mandal and within mandals two villages sown with highest area were selected. In two villages selected under each mandal groundnut cultivators were identified and sample farmers by following simple random sampling technique. In order to track the value chain, commission agents/ traders at major Agricultural Market Committees (AMCs) in Andhra Pradesh based on the volume of transaction were selected.

The data required for the selection of mandals was obtained from the Joint Directorate of Agriculture's, Department of Agriculture (DOA) offices in Anantapur district and Directorate of Economics and Statistics, Hyderabad. Accordingly, Kalyandurgmandal in Anantapur district was selected purposively and villages selected were East kodipalli and Thimmasamudram, from each village 60 farmers were selected at random. The data on farm and household characteristics, socioeconomic parameters like education, details on cultivation practices adopted in groundnut cultivation, marketing of oilseeds, problems in production and marketing by interview method with a pre-tested schedule.

Major regulated markets in Andhra Pradesh were selected based on the volume of transaction of selected crops in each market were selected to track the value chain. The study also intended to study market functionaries, intermediaries at various levels of marketing. The commission agents are agents between farmers and traders/processors in marketing of oilseeds. Traders buy the raw material oilseeds from the AMC market yard. Most of the commission agents are licensed by AMC. The data pertaining to the area, production, productivity of oilseeds, processing units were collected from APOILFED, APMARKFED. Published information by the processors also was obtained.

Oil processing units situated in and around Anantapur and even Hyderabad buy the produce from farmers, traders/commission agents and process the produce. To get more information regarding the processing units, the study is further extended by moving along the value chain to Cuddapah district. Where in Proddatur, there are groundnut processing units. All the available groundnut processing firms were contacted to elicit the required information to map the value chain.

### RESULTS AND DISCUSSION

#### Value Chain: Groundnut

A typical value chain includes primary activities and supporting activities including value addition basically started with industrial application, (Porter, 1985). Value chain analysis is the process of breaking entire chain of activities into its constituent parts in order to better understand its structure and functioning. Value chain of groundnut in the present study comprises of activities that took place at various levels (farm, rural and urban), starting with input supply and continuing through product handling till the industrial application, processing, and

**Table 2: Edible oilseeds production balance sheet**

(Lakh tonnes)

	2011-12	2011-12	2012-13	2012-13	2013-14	2013-14	2014-15	2014-15
	Oil seeds	Oils						
<b>Primary Source</b>								
Groundnut	69.64	16.02	46.95	10.80	97.14	22.34	65.57	15.08
Rape seed and Mustard	66.64	20.47	80.29	24.89	78.77	24.42	63.09	19.56
Soybean	122.14	19.54	146.66	23.47	118.6	18.97	105.28	16.84
Sunflower	5.16	1.70	5.44	1.80	5.04	1.66	4.15	1.37
Sesamum	8.10	2.51	6.85	2.12	7.15	2.21	8.11	2.51
Niger seed	0.98	0.29	1.02	0.31	0.98	0.29	0.73	0.22
Castor	22.95	9.18	19.64	7.86	17.27	6.91	17.33	6.93
Linseed	1.52	0.46	1.49	0.45	1.41	0.41	1.53	0.46
Total	297.98	70.61	309.43	72.03	327.49	77.52	266.75	63.26
<b>Secondary Sources</b>								
Coconut	-	4.00	-	3.90	-	4.30	-	3.8
Cotton	-	11.62	-	11.57	-	12.40	-	12.15
Rice bran	-	7.50	-	7.8	-	8.10	-	9.2
Solvent Extracted oils	-	4.10	-	4.10	-	4.10	-	4.00
Total	-	28.42	-	28.57	-	30.10	-	30.75
Grand Total	-	99.08	-	100.60	-	107.62	-	94.01
Exports and Industrial Use	-	9.46	-	8.41	-	7.10	-	5.94
Net Domestic availability of Edible oils	-	89.57	-	92.19	-	101.9.	-	89.78
Import of Edible oil (US Dollar)	-	99.43	-	106.05	-	109.76	-	83.24
Total Availability /consumption of edible oils	-	189.00	-	198.24	-	211.66	-	-

Source: Directorate of Vanaspati, Vegetable Oils and Fats

distribution. As produce move successively through the various stages, transactions take place between multiple stake holders, money and information were exchanged and value was progressively added. Thus it highlighted the need for enterprise development, enhancement of product quality and safety, quantitative measurement of value addition along the chain, promotion of coordinated linkages among farmers, processors and retailers, and improvement of the competitive position of individual enterprises in the marketplace (Trienekens, 2011).

#### Mapping the Value Chain of Groundnut

Mapping the value chain is done to understand the characteristics of the chain actors and the relationships among them, including the flow of goods through the chain to destination. This exercise was carried out in qualitative and quantitative terms through figures presenting the various stake holders of the chain, their linkages and all operations of the chain from pre-production (supply of inputs) to industrial processing and marketing. It also has constructed a value chain map containing various actors involved in the value chain and showed the linkage potential between actors of value

chain and also studied the relationship and services of supporting markets. This information in the present value chain study was obtained by conducting survey in Anantpur district through well-structured pre-tested schedules, interactions with officials of markets, processors as well as by collecting secondary data from major markets. Value chain mapping facilitated a clear understanding of the sequence of activities involved in the value chain (Hellin & Meijer, 2006).

The generic value chain map of groundnut presented in Figure1 was a diagrammatic representation of different value chain actors operating in the purview of major edible oilseed processing of groundnut. The map was basically structured based on the data collected from the value chain actors. The key stages of pre harvest are represented in the left hand side of the value chain and post-harvest logistics are placed on the right side of the map. The movement of the produce in the map is represented by using arrow marks.

The detailed value chain was presented in Figure1 explained in primary, secondary and tertiary levels i.e., farmer, trader and processor level and its ultimate

**Table 3: Estimates of area, production and yield of groundnut-Andhra Pradesh (Undivided)**

Particulars	Season	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Area (' 000 ha)	Kharif	1615.00	1107.00	1500.00	1500.00	1011.00	1347.00	1057.00
	Rabi	261.00	227.00	295.00	266.00	290.00	275.00	250.00
	Total	1876.00	1334.00	1795.00	1766.00	1301.00	1622.00	1307.00
Production ('000 Tonnes)	Kharif	912.00	333.00	2036.00	1041.20	389.00	888.00	382.00
	Rabi	454.00	410.00	568.00	512.90	617.00	570.00	462.00
	Total	1366.00	743.00	2604.00	1554.10	1006.00	1458.00	844.00
Yield (kg ha <sup>-1</sup> )	Kharif	564.70	300.81	1357.33	694.13	384.76	659.24	361.40
	Rabi	1739.46	1806.16	1925.42	1928.19	2127.58	2072.72	1848.00
	Total	728.14	556.97	1450.69	880.01	773.25	898.89	645.75

Source: Directorate of Economics and Statistics

movement to the final consumer. For convenience figure was discussed in three parts pre-production and production aspects as primary level, markets and movement of produce as secondary level and value addition at tertiary level.

**Primary level:** This deals the preliminary producer (farmer) making preparatory arrangements with local labour support, procuring groundnut seed available only by March-May every year for the ensuing kharif season., fertilizers, pesticides from Govt. and private seed and fertilizer dealers in Kalyandurg and Anantpur.

The primary level key players are the farmers themselves, private and public seed producing companies, seed suppliers/dealers, input suppliers making arrangement for good quality seed, fertilizers and pesticides in desired quantities and credit support etc. The government policies also influence the participation of these players. The input dealers were provided with liberalized licensing are included in subsidy programmes for construction of godowns etc. Thereby became key players in owning the strategic position in supply of inputs like seed, credit and later in storage of the produce.

These input suppliers supply fertilizers and pesticides on credit basis. They organize demonstrations by coordinating with seed companies to gain popularity for the sale of good seed. There is a horizontal integration found among these players. Seed cost of preferred varieties by the farmers, seed availability and quality seed were crucial in the value chain. Horizontal integration is multiple related functions performed by single market value chain actor, like input agent acting as a seed cum fertilizer cum pesticide supplier and as a credit facilitator to the farmer. Farmer also cleans, stores groundnut for seed purpose and for various processed foods. Kumar *et.al.* (2005) surveyed the horizontal and vertical linkages in maize seed value chain. It was found that the information of the access was good to the farmers. The quality of harvest is low and there is less awareness among the farmers on quality production and management.

Groundnut as it is used in processed foods like chutneys are commonly prepared for which groundnut is

roasted and ground with chillies, tamarind and salt used for breakfast foods. Dry powders are also prepared wherein groundnut is roasted, grounded with red chilly powder and little garlic. Groundnut sweets like laddus and chikkys are made from roasted groundnut and jaggery syrup. Groundnuts are also used in fried rice preparation. Boiled nuts in medium brine solution is eaten fresh in households and used as frozen and canned food.

**Secondary level:** Secondary level of the value chain includes commission agents and traders who perform the role of price determination, drying, cleaning and separation from foreign material like soil, vines, stems, and leaves and sell to processors and other players. Traders sell the raw material to the oil processors directly who own the processing units. The produce is also transacted through commission agents and then to traders and finally to the processors. The commission agents directly take the produce to the processors from farmers without the involvement of traders. At this level also horizontal and some degree of vertical integration is observed.

Most of the farmers in Kalyandurgmandal sell the produce to AMCs like Anantpur, Kurnool and Adoni as they are the major markets for groundnut. Later the traders and commission agents of respective AMC s in turn sell the produce to the processors. Traders fix the price according to the prevailing market price and the fluctuations in the share market also cause the changes in price.

Selling the produce to the trader is a kind of logistic arrangement evolved in the marketing process, which can be strengthened for the benefit of farmer. Some of the traders who purchase groundnut from commission agent were Sri surya traders, Hanuman trading company,

**Tertiary level:** At the tertiary level when the question is value addition and creation of value addition and better remuneration to the farmer. Amongst these players groundnut oil processing units, solvent extractor units.

There were traders operating at different sizes, such as Sri Kanaka durga traders, Shaik ahmedbasha traders, Sri Krishna traders, Saikrupa traders, Sri Lakshmi traders, Shakuntala traders, Murali Krishna traders,

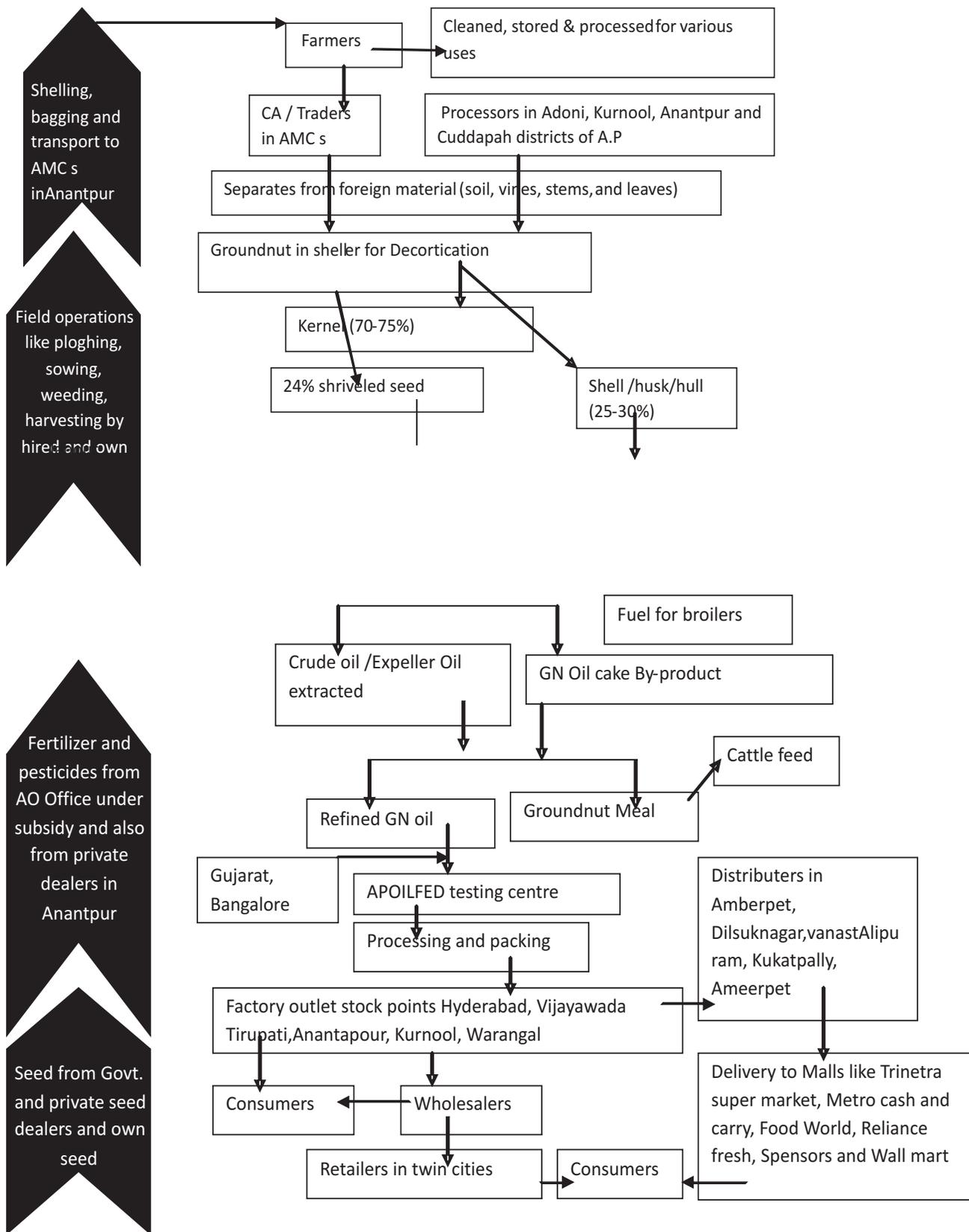


Figure 1: Mapping the value chain of groundnut

Subramaneswamy. The produce brought from the farmers is dried and cleaned by the trader by employing the labour, This also fetches him a good price. The cleaned and dried groundnut is bagged, weighed and transported to the different oil processors in Anantpur, Thadipathri, Cuddapah and Hyderabad.

The groundnut processing units located in Anantpur, Kurnool, Thadipathri, Cuddapah and Hyderabad assume functions like buying substantial good quantities of groundnut not only from Anantpur district but also from other places like Kurnool and Adoni. These processors who take the groundnut in shell go for decortications which gives groundnut kernels. The groundnut seed was used for groundnut oil crushing and expelling which yields main product, expeller oil (35 per cent) and by product groundnut oil cake (63 per cent). The by-product groundnut oil cake which contains 7-8 per cent of oil is again de oiled by solvent extractors and de-oiled cake or groundnut meal is purchased directly by farmers and used as cattle feed. Though this step of groundnut crushing and extraction gives groundnut refined oil. The refined groundnut oil is packed by most of the crushing and expelling units. But there are also oil packing units like APOILFED who purchase the oil from Gujarat and Bangalore and tests the oil for a list of criteria, after the processing for refined oil, it is packed with their brand name Vijaya oils when processed by APOILFED (Andhra Pradesh Cooperative Oil Seeds Grower's Federation). These packed oils were shifted to factory outlets Hyderabad, Vijayawada Tirupati, Anantpur, Kurnool, Warangal. From these points it is directly bought by consumers, wholesalers and distributors. Particularly in the districts like in Hyderabad it is distributed through distributors located in Amberpet, Dilsuknagar, Vanastalipuram, Kukatpally, Ameerpet etc. In turn delivered to malls like Trinetra super market, Metro cash and carry, Reliance Fresh, Food world and Wall Mart. Again from these malls consumers buy the oils. The wholesalers buy the oils from factory outlet sell them to retailers in twin cities and from the retailers the consumers purchase the oil.

#### **Constraints Faced by the Groundnut Farmers and Traders**

The groundnut farmers in Anantpur district faced problem of own seed storage. As the seed rate of groundnut is quite high and it is also a bulky crop so farmers faced not only space constraint but also pest infestation on the stored groundnut seeds. Groundnut is susceptible to mycotoxins if there is moisture left over in the seed after drying. Commission charges to be paid at the AMC s, transportation of the produce to the market, Adinya (2009), the low price offered for the produce at the time of harvest, defective and faulty weighting, Nonpayment/ untimely payment and Forced sale due to burden of repayment of loan. In addition to the above major constraints one of the major constraints faced by farmers in Anantpur district is with regard to availability of good quality groundnut seed. Producers also complained that the season subsidy given

by the Government is untimely. Fertilizer availability is untimely and sometimes out of stock and no standard pesticides and there were lot of pesticides available and so many new ones boom always as there is no control on pesticides. Moreover the produce is to be sold to millers directly the available local millers/processors were less and millers from far away were not interested to come to the village and buy.

The constraints faced by the traders in the study area are price fluctuations, transport costs and that the traders were getting thin margins and the expenses they were incurring were high, the storage facilities were also inadequate, ranked and they dispose the produce immediately even if the price is not fetching to them. The millers also offer low cost for the produce the reason was the quality was not good. There is aflatoxin problem and low grain quality problem in groundnut. The spoilage of produce during storage, processing and after processing is prevalent in groundnut.

#### **CONCLUSIONS**

The value chain of groundnut can be understood that the right from production there is no proper care taken from seed, research on new cultivars, problem in uniform maturity, seed cost, minimum support price and harvesting losses were seen. After the harvest non availability of shellers, recovery of kernals, no machinisation meeting the specific requirements of farmers and absence of storage space were prominent. Taking care of these above arrangements and involvement of those institutions to intervene and protecting the produce from losing its quality in the process of movement along the value chain will help groundnut to overcome the drawbacks to regain its prime position in edible oils production and consumption.

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## **Enhancing Farmer's Income through Crop Diversification: A Case of Contract Farming of Chicory Cultivation in Punjab Agriculture<sup>#</sup>**

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### **ABSTRACT**

*The present paper analyzes the profitability and income from chicory, a newly introduced crop in Punjab agriculture and emphasizes the need for diversification for increasing farmer's income. Primary data pertaining to the year 2014-15 was collected using personal interview method from a sample of 60 chicory growers scattered over 38 villages of five districts of Punjab namely Amritsar, Jalandhar, Gurdaspur, Hoshiarpur and Tarn Taran through purposive sampling technique. The comparative economics revealed that the total variable cost was almost two and a half times higher in chicory than wheat whereas chicory crop gave much higher returns than wheat crop. The net returns came out to be ₹55582.13 for chicory whereas it was ₹41533.47 per hectare for wheat depicting a difference of ₹14048.66. Although the net returns were more in chicory crop but benefit-cost ratio of wheat was more by a difference of 0.69. The per hectare net returns for the most successful chicory grower was ₹118044.80 which was 112.37 per cent higher than the average net returns of chicory growers. Had this crop been grown with fully developed package of practices, the farmers would have earned more. The important constraints in the cultivation of this crop were delayed payment, high labour needs inadequate facilities for unloading the crop and lack of technical knowledge.*

### **Keywords**

Chicory, cost-benefit analysis, Punjab

### **JEL Codes**

D61, O13

### **INTRODUCTION**

For sustainable development of Punjab agriculture and enhancing farm income there is a strong need to develop proper package involving crop diversification, technological innovations, agro-processing and institutional changes for reducing cost of production so that the dream of 'Doubling Indian Farmer's income by 2022' can be relished. It was the green revolution that pulled the country from the clutches of food-crisis and made it a food surplus economy. Punjab played a significant role in green revolution and it were the tenacious farmers of the state who proved their mettle. No doubt, on the road to green revolution Punjab virtually exported its water and nutrients to other states. The state has discharged its 'national duty' at a very high cost. On the one hand, the mono-cropping in the state has led to serious implications as regards the degradation of soil and water resources. On the other hand, rise in cost of

cultivation and lowering of farmers income has led to farmers' suicides and rise in agrarian distress in the state. One of the major reasons is the faulty agricultural marketing system that leaves farmers with a lesser share and maximum is eaten up by the intermediaries and private traders. This not only leads to cost escalations but also deteriorates the quality of the produce hitting the producers as well as consumers (Sharma, 2014). The farmer gets only 35 per cent of the value whereas majority of the price hike is done by the intermediaries (Government of India, 2009). The need for well-functioning marketing structure has therefore been recognized by the government in the twelfth plan and it emphasizes the promotion of direct marketing, contract farming (C.F) (Government of India, 2013).

Diversification through contract farming relieves farmer from credit and input-output market constraints, and enabling him to apply inputs at an optimum level.

<sup>#</sup>*This paper is a part of M.Sc. thesis entitled Contract Farming of Chicory in Punjab: An Economic Analysis submitted to Punjab Agricultural University, Ludhiana, Punjab, 2017*

Better technology and management practices in contract farming brought by the processors increase the overall farm productivity and efficiency (Swain, 2016). This paper looks at the contract farming of chicory cultivation in Punjab, a newly introduced crop in the state and compares the profitability of chicory with its competing crop that is wheat. Chicory as a product is unique in the sense that it had only one well-known use, i.e. an ingredient to coffee. Some coffee planters in India also call chicory as an adulterant to coffee. The cultivation of chicory in India is not much popular as farmers are not aware about crop. With the development in technology, chicory crop has gained importance as it is very useful in making blend with coffee. The mixture of chicory and coffee allows the coffee manufacturers and retailers to keep the prices of coffee within affordable range so as to cover a large number of consumers. This is probably the most important reason for many private firms and Multinational Companies (MNCs) to take keen interest in the cultivation of chicory (Vaswani *et al.*, 2003). It is expected that the farmers would get better returns on growing chicory cultivation than wheat, if grown successfully. In this backdrop, the present paper analyzes scope of chicory cultivation through contract farming in Punjab.

**MATERIALS AND METHODS**

The study was conducted in the Punjab state. Chicory cultivation is recently introduced by Hindustan Unilever limited through the local firms Harraj Agro Foods Pvt. Ltd. and APJ Pvt. Ltd. The acreage under this crop is few acres spread in the areas of Amritsar, Hoshiarpur, Gurdaspur, Jalandhar, Pathankot, Moga, Faridkot etc. The list of chicory growers was collected from the Harraj Agro Foods Pvt. Ltd. and APJ Foods Pvt. Ltd. who are engaged in the production of this crop in Punjab state. A purposive sampling technique was adopted for the selection of the sample. At the first stage five districts i.e. Amritsar, Jalandhar, Gurdaspur, Hoshiarpur and Tarn Taran has been selected. As the chicory growers were scattered over many villages, thus eighteen villages from Amritsar district, seven from Gurdaspur district, six from Jalandhar district, three from Tarn Taran and four from Hoshiarpur became the part of the present study. Thus a sample of 60 chicory growers was selected from 5 districts namely Amritsar, Jalandhar, Gurdaspur, Hoshiarpur and Tarn Taran covering 38 villages for the year 2014-15. The primary data were collected from the respondent farmers with the help of specially designed and pre-tested schedule through personal interview method. Simple statistical techniques such as averages, percentages were applied in the analysis. Benefit-cost ratio was worked out to identify the relationship between the cost and benefits of this study.

**Likert scale**

Five point Likert scale was used to find the severeness of problems faced by sampled respondents. It was developed by Rensis Likert, an American social

psychologist. It is a most widely used approach for scaling responses in survey research. The sample farmers were asked to give number to each constraint, that is, 1 for no problem, 2 for low, 3 for moderate, 4 for high and 5 for severe problem. At last results were obtained by analyzing the data, constraint with highest mean importance recognized as the severe problem.

**RESULTS AND DISCUSSION**

**Socio-economic Profile of Chicory Growers**

Majority of the chicory growers (63.3 per cent) belonged to the age group of 20-50 years. About 11.7 per cent of them were in the age group of above 60 years. This clearly revealed that the majority of the chicory growers were almost in the middle age group (Table 1). Educational status is one of the most important determinants of the socio-economic condition of the farm family. The educational status of the head of the family was enquired from the selected households, who acted as decision makers in the family. The educational status of the family head revealed that the highest proportion (45 per cent) of the sample farmers had passed Matric, followed by 25 per cent who had passed senior secondary, whereas 13.3 and 6.7 per cent were graduates and post graduates respectively. Only 6.7 per cent of the chicory growers were illiterate. This clearly depicted that most of the sample farmers were well educated to understand and implement the advance agronomic practices in the

**Table 1: Socio-economic profile of chicory growers of Punjab, 2014-15**

Age of respondents (years)	Number	Percentage
20-30	3	5.0
30-40	12	20.0
40-50	23	38.3
50-60	15	25.0
above 60	7	11.7
<b>Education status of the sample farmers</b>		
Illiterate	4	6.7
Up to Primary	2	3.3
Up to Matric	27	45.0
Senior Secondary	15	25.0
Graduate	8	13.3
Post Graduate	4	6.7
<b>Farm size category</b>		
Marginal (0-1 ha)	0	0.0
Small (1-2 ha)	0	0.0
Semi-medium (2-4 ha)	5	8.3
Medium (4-10 ha)	27	45.0
Large (>10 ha)	28	46.7
<b>Occupation</b>		
Agriculture	45	75.0
Agriculture and other activities*	11	18.3
Agriculture and dairy	4	6.7
Total sample size	60	100.0

\*Other activities included government and private job, commission agent, own business etc.

cultivation of chicory crop in Punjab. The categorization of sample farmers into different farm size categories revealed that chicory cultivation was mostly adopted by large and medium category of farmers as the highest proportion i.e. 46.7 per cent of the respondents were large farmers, followed by 45 per cent as medium farmers and remaining only 8.3 per cent as semi-medium farmers. Among the sample farmers, small and marginal farmers were not engaged in contract farming of chicory. This may be due to high production cost on the cultivation of chicory or risk in the adoption of new crop. Though the main occupation of the sample respondents was farming, yet they had some other occupations like dairy, private/government services, commission agents, business, etc. About 25 per cent of the farmers incurred income from other sources which is as important as from agriculture to sustain livelihood.

#### Cropping Pattern of the Sample Farmers

The cropping pattern indicates the extent of area grown of each crop as a percentage to the gross cropped area. The types of crop raised on farms, the proportion of farm area put under different crops, and the number of times a given unit of land is being cultivated during a year are important dimensions ought to be considered in evaluating land use pattern. It is evident from the Table 2 that gross cropped area was 35.35 ha out of which paddy and wheat dominated the cropping pattern because these crops covered a significant area of 34.17 per cent and 21.44 per cent respectively. A sizeable proportion of gross cropped area ranging from 4-9 per cent was covered by sugarcane, winter maize, peas, potato and chicory in the cropping pattern of sample farmers. Other crops in the kharif season includes popular plantation and kharif fodder (1.36 per cent) whereas in rabi season it includes

**Table 2: Cropping pattern of the sample farmers, Punjab, 2014-15**

Crop	Area (ha)	Percentage
<b>Kharif</b>		
Paddy	12.08	34.17
Sugarcane	1.72	4.87
Fodder	0.48	1.36
Others*	0.78	2.21
<b>Rabi</b>		
Wheat	7.58	21.44
Sugar beet	0.18	0.51
Sugarcane	1.72	4.87
Winter maize	2.54	7.19
Fodder	0.49	1.39
Peas	1.90	5.37
Potato	3.30	9.33
Chicory	1.40	3.96
Others*	1.18	3.33
Gross cropped area	35.35	100.00

\*Others include area under popular in kharif season and in rabi season, it also includes vegetables like tomato and beans

rabi fodder and winter vegetables like tomato and beans (3.33 per cent).

#### Time of Sowing, Harvesting and Yield of Chicory Crop

Time of sowing plays an important role for germination, growth, yield, and root quality of chicory plants. The contracting firm was of the view if farmers observe the optimum time of sowing i.e. last fortnight of October till first fortnight of November, will get a yield of 500 quintals per hectare. But, in reality, there was too much variation in the time of sowing that is, from second fortnight of October to first fortnight of January (Table 3). The highest proportion of sample farmers that (25 per cent) planted their crop in first fortnight of November followed by 23.3 per cent of farmers who went for sowing of crop in second fortnight of October. The highest average yield of 420 quintals per hectare was realized by the sample farmers who sow their crop in the second fortnight of October. As the sowing time descends from October to January, the average yield decreases. This implies that the early sown chicory crop gave better yield as compared to late sown crop. Major proportion of the sample farmers (i.e. 70 per cent) sowed the crop till 30<sup>th</sup> November which implies that out of sample of 60 farmers, 42 farmers had sown the crop till 30<sup>th</sup> November whereas only 18 farmers had sown the crop after November.

Chicory is a hardy plant and can tolerate extreme temperatures during its vegetative and reproductive phases of growth. For successful seed germination chicory needs a minimum temperature of 21<sup>o</sup> C, while for good plant growth it requires a moderate and uniform

**Table 3: Time of sowing, harvesting and yield of chicory crop by sample farmers in Punjab, 2014-15**

Particulars	Number of farmers	Average yield (quintals per hectare)
<b>Time of sowing</b>		
15-30 October	14 (23.3)	420.0
1-15 November	15 (25.0)	394.3
16-30 November	13 (21.7)	301.0
1-15 December	6 (10.0)	285.5
16-30 December	7 (11.7)	284.0
1-15 January	5 (8.3)	242.5
<b>Time of harvesting</b>		
1-10 May	2 (3.4)	400.0
11-20 May	8 (13.3)	398.7
21-31 May	24 (40.0)	344.7
1-10 June	23 (38.3)	331.0
11-20 June	3 (5.0)	245.7
<b>Yield (in quintals)</b>		
Less than 250	10 (16.6)	196.2
250-375	28 (46.7)	325.0
375-500	22 (36.7)	434.2
Total	60 (100.0)	

Figures in the parentheses indicate percentages to the total sample size

temperature, with the optimum at 18-24<sup>o</sup> C. It grows most rapidly, when conditions are warm and the mean monthly temperature does not exceed 25<sup>o</sup> C (Bais & Ravishankar, 2001; Anonymous 2012)

It has been observed that the sample farmers harvested the crop from 1<sup>st</sup> week of May till end June. The highest proportion of farmers harvested their crop during last fortnight of May till first week of June i.e. 78.3 per cent, depending upon the availability of harvester by the contracting firm. But the average yield was higher for those chicory growers who harvested during first fortnight of May. Some of the sample farmers reported that harvesting should be done in the month of April than May and June to avoid weight loss of the crop. There was a huge variation in the yield of chicory crop which varied from 162.5 quintals to 500 quintals per hectare against the stated yield by the contracting firms. This was due to lack of knowledge about various operations during crop stages by the sample farmers which the contracting firm was supposed to provide but they failed. About 46.7 per cent of the farmers got average yield of 325 quintals per hectare whereas 36.7 per cent of the farmers had average yield of 434.2 quintals per hectare.

#### Comparative economics of wheat and chicory crop

Chicory being a winter season crop competes with rabi season growing crops, as such a comparison was drawn with major rabi crop that is, wheat to visualize the comparative cost and return structure of both crops (Table 4). Though average per hectare cost of cultivating chicory was almost double than that of wheat, but the crop gave one and a half times more gross returns than the main competing crop wheat. The per hectare returns over variable cost was ₹55582 and ₹41533 for chicory and wheat respectively. The benefit-cost ratio was lower in case of chicory crop as the crop could not perform well in the field, being a new crop; lack of technical know-how

was the major hindrance which resulted in low profitability. The contracting firm, at the time of contract told the farmers that the productivity of the crop will be 500 quintals per hectare and with a price of ₹350 per quintal; the returns the farmers will be getting will be ₹175000 per hectare. But the average yield was 343.63 quintals and the average price realized was ₹335.25 per quintal, giving much lower gross returns than expected by the farmers. Only 3 farmers got yield of 500 quintals per hectare. Due to lack of market and well established agronomic practices, the profitability of chicory was less than wheat crop.

The average yield of chicory came out to be 343.63 quintals whereas for the most successful chicory grower it was 500 quintals. Among the sample farmers, based on net returns, the most successful farmer was identified as S. Nirmal Singh of village Landhra, district Jalandhar, 62 years old, had passed matric cultivating 42 acres of land; of which 6 acres was under chicory cultivation. The yield came out to be 500 quintals per hectare which was 45.51 per cent higher than the yield of average chicory producer. The price realized was ₹350 for most successful chicory grower which was 4.40 per cent higher than the average chicory price (Table 5).

Had the net returns for all the chicory growers were by and large same as most successful grower, then the sample farmers' income would have been doubled as is evident from the results. The per hectare returns of most successful chicory grower was ₹118044 whereas average net returns for the sample was ₹55582; a little bit more than double. An interesting fact to note here is that maximum yield of wheat among sample farmers was 55 quintals per hectare, given the price as ₹1450 per quintal for the year 2014-15; the maximum net returns earned from wheat were ₹65450. Whereas the maximum net

Table 4: Comparative economics of wheat and chicory crop on sample farms in Punjab, 2014-15

Particulars	Chicory	Wheat	Difference
Human labour	33577.30	10815.75	22761.55
Machine labour	9476.10	4544.15	4931.95
Seed	2367.70	1787.30	580.40
Manures and fertilizers	9496.45	5225.28	4271.17
Agricultural chemical/weedicides	2134.93	2077.50	57.43
Irrigation	-	-	-
Interest @ 9 per cent per half of the period of crop on operational cost	2567.35	1100.25	1467.10
Total Variable cost	59619.83	25550.23	34069.60
Yield-Main product, q/ha	343.63	40.33	303.3
Price-main product, ₹/q	335.25	1450.00	-1114.75
Gross returns	115201.96	67083.70*	48118.26
Returns over variable cost	55582.13	41533.47	14048.66
Benefit-cost ratio	1.93	2.62	-0.69

\*Gross returns of wheat includes value of by product also

**Table 6: Problems in the production and marketing of chicory faced by the sample farmers, Punjab, 2014-15**

Problems	Mean importance	Standard deviation	t-value	p-value
Delayed payment for crop produce	2.88	1.52	-0.59	0.55
High labour needs (due to manual weeding and harvesting)	2.37	1.52	-3.23	0.00
Inadequate facilities of unloading the crop	2.33	1.61	-3.20	0.00
Lower price for crop produce	1.83	1.21	-7.47	0.00
Lack of technical knowledge	1.32	0.70	-18.60	0.00
Low contract price received against stated contract price	1.17	0.67	-21.26	0.00

**Table 5: Returns from the most successful and least successful chicory growers, Punjab, 2014-15**  
(₹/ha)

Particulars	Most successful grower	Least successful grower	Average value
Yield (q/ha)	500 (45.51)	162.5 (-52.71)	343.63
Price (₹/q)	350 (4.40)	350 (4.40)	335.25
Gross returns	175000.00 (51.91)	56875.00 (-50.63)	115201.96
Total variable cost	56955.20 (-4.47)	55251.07 (-7.33)	59619.83
Returns over variable cost	118044.80 (112.37)	1623.93 (-97.08)	55582.13

Figures in parentheses are difference over average values

returns from chicory cultivation came out to be ₹118044, almost double than that of wheat crop.

### Problems

The perusal of Table 6 indicated that among various problems faced by contract farmers of chicory, delayed payment with highest mean importance, 2.88 (SD=1.52) was the major problem faced by chicory growers in Punjab. The other major problems faced by the farmers were low contract price received against stated price and poor technical guidance.

### CONCLUSIONS

The majority of the chicory growers were almost in the middle age group i.e. 20-50 years. They were well educated to understand and implement the advance agronomic practices in the cultivation of chicory crop as 45 per cent of them had passed matric. Chicory cultivation was mostly adopted by large category of farmers. This may be due to high production cost on the cultivation of chicory or risk in the adoption of new crop. Though, the main occupation of the respondents was farming, yet they had some other occupations like dairy, government and private jobs, commission agents and own business etc.

Paddy and wheat dominated the cropping pattern and accounted for 34.17 per cent and 21.44 per cent of gross cropped area respectively, whereas chicory crop covered almost 4 per cent of the gross cropped area. The average

yield was higher for the sample farmers which went for early sowing of crop. As the planting time descends from October to January, the average yield decreased. It has been observed that the sample farmers harvested the crop from 1<sup>st</sup> week of May till end June. The average yield was higher for those chicory growers who harvested during first fortnight of May. The comparative economics of chicory and wheat crop revealed that chicory gave much higher net returns than the wheat crop; almost one and a half times the wheat crop.

The benefit-cost ratio of wheat crop was more by a difference of 0.69. The important constraints in the cultivation of this crop were delayed payment, high labour needs, inadequate facilities of unloading the crop and lack of technical knowledge. Lack of market and inadequate prices are the main hindrances in the crop, hence, contract farming model where various stakeholders commit themselves to their specific role in the entire venture will reap fruits only in case farmers get proper prices and technical know-how of the crop.

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## **Adoption and Impact of Paddy Production Technology in Maharashtra**

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### **ABSTRACT**

*The present study was taken up to analyze the adoption and impact of production technology of paddy in Maharashtra. The primary data were collected 288 paddy cultivators for the period of 2013-14. Based on the data of costs and returns structure, benefit-cost ratio (BCR), yield gap analysis, decomposition analysis, adoption index and impact of improved paddy technology have been estimated in the study. For the state as a whole, Cost 'C' per hectare was worked out to ₹47,652.48 and it was 1.27 B: C ratio. The cost of production per hectare has increased with the increase in technology adoption however, per unit cost has decreased with increase in technology adoption. Further; there was a 16.08 per cent yield gap between actual yield and yield of demonstration plot. The composite index of technology adoption was 54.38 per cent, which indicated that the sample farmers adopted less than 46 per cent recommended paddy production technology and obtained 36.56 q/ha yield. The contribution of different components on impact of paddy production technology was maximum in net returns (63.00 per cent). The improved paddy production technology method being more skill oriented, the study has observed that yields can be increased on adoption of improved method of paddy production technology.*

### **Key words**

Decomposition model, improved production technology, technology adoption index, yield gap

### **JEL Codes**

Q 12, Q 13, Q 14, Q 19, Q33

### **INTRODUCTION**

Paddy (*Oryza sativa L.*) is one of the important cereal crops of the world and forms the staple food for more than 60 per cent of the world people. Rice has shaped the culture, diets and economics of thousands of millions of people. India is one of the leading rice producing countries of the world with cultivated area of 43.97 Mha and production of 100 Mt in 2011-12. The leading states in rice cultivation are: West Bengal, Uttar Pradesh, Orissa, Andhra Pradesh and Panjab. Maharashtra is one of the major rice growing states in India. Paddy is grown on 15.40 million ha with an annual production of 35.00 million tonnes and productivity at 1821 kg/ha during the year 2011-12. Maharashtra ranks 12<sup>th</sup> in production and 13<sup>th</sup> in productivity among major rice growing states of the country (India Stat.Com, 2011).

Paddy is the second largest important crop next to jowar in Maharashtra. The position of Maharashtra in rice production is comparatively poor. In the state, paddy is grown in districts with varying extent. However, the major rice growing districts are Thane and Raigad in

Konkan region, Kolhapur and Nasik districts in Western Maharashtra region, Nanded and Parbhani districts in Marathwada region, Bhandara and Gondia districts in Vidarbha region (Anonymous, 2012).

The present study is an attempt to analyze the impact of improved technologies on paddy production in Marathwada regions of Maharashtra. The study undertaken so far had mostly focused on the favorable effects of technological change. The reasons for the rate of adoption lagging behind expectation have been virtually unexamined. Therefore, a study which focuses on both aspects of technical changes i.e. its impact on yield, returns etc. as well as the reasons for non-adoption of improved technology assumes great importance. Considering the above facts it was necessary to analyze the "Adoption and Impact Assessment of Paddy Production Technology in Maharashtra".

### **METHODOLOGY**

The study was conducted in Maharashtra state as whole. The State of Maharashtra comprises of each region of two districts i.e. Konkan (Thane and Raigad), Western

Maharashtra(Kolhapur and Nasik), Marathwada (Nanded and Parbhani) and Vidarbha (Bhandara and Gondia) were selected on the basis of maximum area under paddy. From each district, 36 farmers were selected as per the size group of small, medium and large farmers who were practicing improved production technology of paddy of cultivation. The study was based on primary data for the year 2013-14. Thus, there were a total number of sample size of 288 farms. The farmers were interviewed using specially prepared schedules.

**Analytical tools**

The standard costs concept were used to estimating costs viz; 'A', 'B' and 'C' costs.

**Technological Gap Analysis**

Yield gap was worked out as the difference between demonstration plot yield and actual farmer's yield. The following Cobb-Douglas type of production function was used for this purpose (Guddi *et al.*, 2002).

$$Y = a_0 H^{a_1} B^{a_2} M^{a_3} P^{a_5} e^u$$

Where,

Y = Output of main produce in quintals per hectare

a<sub>0</sub> = Intercept

H = Per hectare use of human labour in man days

B = Per hectare use of Bullock in pair days

M = Per hectare use of Manure in quintals

N = Nitrogen (kg) per hectare

P = Phosphorus (kg) per hectare

e<sup>u</sup> = error term

a<sub>1</sub> to a<sub>5</sub> elasticities of production.

The combination of different resources to yield gap was estimated with the help of Decomposition Model. The following functional form was used to work out the yield gap (Bisaliah, 1977). The Chow Test was conducted for checking the production elasticity of the two functions.

$$\text{Log}(Y_2/Y_1) = [\text{Log}(b_0/a_0)] + [(b_1-a_1) \text{Log} H_1 + (b_2-a_2) \text{Log} B_1 + (b_3-a_3) \text{Log} M_1 + (b_4-a_4) \text{Log} N_1 + (b_5-a_5) \text{Log} P_1] + [b_1 \text{Log}(H_2/H_1) + b_2 \text{Log}(B_2/B_1) + b_3 \text{Log}(M_2/M_1) + b_4 \text{Log}(N_2/N_1) + b_5 \text{Log}(P_2/P_1)] + [U_2-U_1]$$

**Technological Adoption Index**

Technology Adoption Index (TAI) was worked out as per Kiresur *et al.* (1996) with the help of following formula.

$$TAI = \frac{A_i}{M_i} \times 100$$

Where,

A<sub>i</sub> = Average adoption score registered by the farmer for particular component

M<sub>i</sub> = Maximum adoption score registered by the farmer for particular component.

**RESULTS AND DISCUSSION**

**Resource Use Gap of Paddy**

For the State as a whole (Table 1), per hectare resource use gap between yield on sample cultivators farm and demonstration plot was 19.07 per cent. The inputs of human labour, bullock power, manures and potash were utilized less than the demonstration plot, while in case of sample cultivators farm, the per hectare use of seed, nitrogen and phosphorous were utilized more than the demonstration plot, for poor germination, flooding condition, maintaining the plant population and to increase the grain production. It can be concluded that, for obtaining the desirable yield, resources should be used at optimum level.

**Cost, Returns, Gross Income and BC Ratio of Paddy**

It is revealed from Table 2, at the overall level, State as whole per hectare cost of cultivation of paddy, Cost 'C' was ₹47,652.48 and gross income was ₹60,878.79. Per quintal cost of paddy was ₹1,202.83 and with B: C ratio 1.27. From the above discussion it is indicated that per unit cost of cultivation declined as size group increase and that results into more (1.30) profitability in medium size group. Therefore, this study suggests that, to make cultivation of paddy profitable, it is essential that the average yield should be raised and harvest prices should be remunerative.

**Cost, Returns, Gross Income and BC Ratio of Paddy**

It is revealed from Table 2, at the overall level, State as whole per hectare cost of cultivation of paddy *i.e.* Cost 'C'

**Table 1: Resource use gap of paddy in Maharashtra**

Particulars	(Per ha)			
	Demonstration plot	Sample cultivators	Absolute Gap	per cent Gap
Total Human labour (Days)	169.63	135.94	33.69	19.86
Bullock power (Pair days)	12.25	10.86	1.39	11.34
Seed (kg)	36.25	87.33	-51.08	-140.91
Manures (q)	93.75	17.07	76.68	81.79
Fertilizers (kg)				
N	95.00	103.46	-8.46	-8.91
P	50.00	96.62	-46.62	-93.24
K	50.00	20.96	29.04	58.08
Yield (q)	44.50	36.01	8.49	19.07

-Gap indicates excess use than recommendation; +Gap indicates low use than recommendation

Table 2: Costs and return structure of paddy in Maharashtra

Particulars	Unit	Size groups			
		Small	Medium	Large	Overall
(₹Per ha)					
<b>Total cost</b>					
i) Cost 'A'	₹	31275.74	27718.11	28842.27	28953.60
ii) Cost 'B'	₹	43225.95	40115.25	41525.15	41415.49
iii) Cost 'C'	₹	49775.10	46343.85	47715.14	47652.48
<b>Profit at</b>					
i) Cost 'A'	₹	26686.51	32966.71	33219.39	31925.19
ii) Cost 'B'	₹	14736.30	20569.57	20536.51	19463.30
iii) Cost 'C'	₹	8187.15	14340.97	14346.52	13226.31
Production	q	33.50	34.61	37.64	36.01
Gross income	₹	57962.25	60684.82	62061.66	60878.79
<b>B:C ratio at</b>					
i) Cost 'A'		1.87	2.19	2.13	2.09
ii) Cost 'B'		1.34	1.50	1.47	1.46
iii) Cost 'C'		1.16	1.30	1.29	1.27
Per quintal cost	₹	1353.04	1219.66	1150.04	1202.83

was ₹47,652.48 and gross income was ₹60,878.79. Per quintal cost of paddy was ₹1,202.83 and with B: C ratio 1.27. From the above discussion it is indicated that per unit cost of cultivation declined as size group increase and that results into more (1.30) profitability in medium size group. Therefore, this study suggests that, to make cultivation of paddy profitable, it is essential that the average yield should be raised and harvest prices should be remunerative.

#### Cobb-Douglas production Function Estimate for Demonstration Plot and Sample Farms

The results Cobb-Douglas production function estimate for demonstration plot and sample farms in Maharashtra are presented in Table 3. In the case of demonstration plot method, human labour, seed and manures were found positively significant. This means that usage of less than the recommended dose of these inputs would result in a increase in production. On sample cultivators farm, human labour, bullock labour, manures and potash were positively significant. Thus, the sample cultivators' farms were more labour intensive and exhaustive as it responded more to labour usage, manures and application of chemical fertilizers. This result was in conformity with those of Bisaliah (1977) for Punjab wheat economy and Rama Rao *et al.* (2011) for paddy economy in Andhra Pradesh.

#### Results of Decomposition Analysis

Table 4 depicted the results of decomposition analysis in Maharashtra. There was 19.07 per cent yield difference because of adoption of practicing new technology in paddy cultivation. In 19.07 yield gap measurably (11.24 per cent) was contributed by differences in cultural practice, whereas remaining 7.83 per cent of yield was due to difference in use of input. The maximum positive

difference of input use level was found from phosphorous followed by potash, bullock labour, manures and nitrogen.

Table 3: Cobb-Douglas production function estimate for demonstration plot and Sample farms in Maharashtra

Particulars	Method of cultivation	
	Sample cultivator farms	Demonstration plot (Recommended)
Intercept	0.6048	0.9433
Human labour (X <sub>1</sub> )	0.6863*** (0.2375)	0.3210** (0.1389)
Bullock labour (X <sub>2</sub> )	0.0629** (0.0243)	0.0185 (0.6234)
Seed (X <sub>3</sub> )	0.7945 (0.9978)	0.2978* (0.1260)
Manures (X <sub>4</sub> )	0.0993*** (0.0331)	0.0331*** (0.0114)
Nitrogen (X <sub>5</sub> )	0.0049 (0.0078)	0.0166 (0.0168)
Phosphorus (X <sub>6</sub> )	0.0026 (0.0297)	0.0151 (0.2174)
Potash (X <sub>7</sub> )	0.0478** (0.0216)	0.0145 (0.2241)
R <sup>2</sup>	0.75	0.69
Observation	274	120
D.F.	266	112
Fvalue	17.97***	13.6***

Figures in parentheses are standard errors of respective regression coefficients.

\*, \*\* and \*\*\* significant at 10, 5 and 1 per cent level, respectively

**Table 4: Results of decomposition analysis in Maharashtra**

Source of productivity difference	Percentage contribution
Total difference observed in output	19.07
Source of contribution	
1. Difference in cultural practices (Non-neutral technological changes)	11.24
2. Due to difference in input use level (Neutral technological changes)	
a. Human labour	1.26
b. Bullock labour	3.39
c. Seed	-1.34
d. Manure	-0.57
e. Nitrogen	1.56
f. Phosphorous	2.54
g. Potash	1.04
Due to all inputs	7.83
Total estimated gap from all sources	19.07

Whereas, seed (-5.18 per cent) and human labour (-0.07 per cent) were contributing negatively towards the yield gap. Thus, the total difference in output was measurably caused by difference in cultural practices, rather than differences in input level. These findings are confirmed with Kiresur (1996); Rama Rao (2011).

**Technology Adoption Index on Sample Farms**

Table 5 indicated that, State as whole the adoption index of method of sowing technology component was

**Table 5: Technology adoption index of paddy in Maharashtra**

Component	Size group			Overall
	Small	Medium	Large	
Date of sowing	65.00	69.00	76.00	69.91
Seed rate	58.00	65.00	70.00	64.24
Variety	47.00	53.00	60.00	53.30
Method of sowing	87.00	91.00	92.00	89.93
Manures	24.00	35.00	40.00	32.98
Nitrogen	62.00	68.00	73.00	67.70
Phosphorous	53.00	65.00	68.00	62.04
Potash	16.00	20.00	30.00	21.76
Plant protection	11.00	18.00	22.00	17.01
<b>Composite index</b>	<b>44.19</b>	<b>50.76</b>	<b>54.73</b>	<b>49.89</b>
<b>Yield (q)</b>	<b>33.50</b>	<b>34.61</b>	<b>37.65</b>	<b>36.01</b>

maximum (89.93 per cent) on sample farms followed by date of sowing, nitrogen, seed rate, phosphorus and variety. At the overall level, the lowest technology was noticed in case of application of manures component and plant protection measures. State as whole the composite index of technology adoption was worked out to 49.89 per cent indicated that the sample farmers adopted less than 50.00 per cent recommended paddy production technology obtaining 36.01q/ha yield. The positive relationship was observed in between composite index and yield obtained on sample farms *that is*, increase in composite index resulted in increase in yield. It was also noticed that the composite index increased as size of holding increased.

**Table 6: Impact of improved paddy production technology in Maharashtra**

Particulars	Local Method	Improved method	Per cent impact
<b>Employments</b>			
1. Total human labour (Man days/ha)	112.99	135.94	16.88
2. Bullock labour (Pairs days)	7.78	10.86	30.21
3. Machine power in hrs	4.81	7.55	36.17
<b>Yield (q/ha)</b>			
1. Main produce	26.67	36.01	30.43
2. By-produce	33.62	43.38	23.07
<b>Economics (₹/ha)</b>			
1. Gross returns	43689.38	60878.79	28.24
2. Cost of cultivation	37818.26	47652.48	20.64
3. Net returns	5871.13	13226.42	55.61
B:C ratio	1.16	1.27	
<b>Cost effectiveness of improved paddy production technology</b>			
1. Added returns	-	17189.51	-
2. Added cost	-	9834.21	-
3. Added yield (q)	-	10.96	-
4. Per cent increase in yield	-	43.74	-
5. Cost (₹/q)	1509.70	1323.40	-
6. Unit cost reduction (₹/q)	-	186.29	-
7. Per cent reduction	-	12.34	-
8. ICBR ratio	-	1.75	-

### Impact of Improved Paddy Production Technology

It is revealed from the Table 6, per hectare yield increased as farmers adopt the higher level of improved production technology for paddy. Per hectare yield has increased from 26.67 to 36.01 quintal per hectare over the difference level of adoption. The added yield was 10.96 q/ha over the local and improved method of adoption. Thus, for producing extra yield per hectare costs were also increased ₹9,834.21 and added returns were also increased ₹17,189.51.

The ICBR ratio indicates that the high adoption improved production technology adopter farmers were in profit with 1.75 ICBR ratio. It indicates that, the farmers should adopt the improved production technology for paddy to the fuller extent for maximizing returns and minimizing per unit cost.

### CONCLUSIONS

The maximum resource use gap was observed in use of FYM and potassic fertilizers and the yield gap of 19.07 per cent was noticed between demonstration plot yield and sample cultivator farms. The cost of production of paddy was ₹1,202.83 per quintal and the Benefit: cost ratio of paddy was greater than unity. Therefore, paddy is profitable enterprise. The decomposition analysis revealed that, the contribution to the difference in total productivity due to cultural practices was 11.24 per cent while due to input use level, it was 7.83 per cent for the State as a whole.

State as whole the composite index of technology adoption was worked out to 49.89 per cent indicated that the sample farmers adopted less than 50.00 per cent recommended paddy production technology obtaining 36.65 q/ha yield. The contribution of component on impact of paddy production technology, net returns was maximum (43.97 per cent) followed by gross returns and main produce. The high level adoption of paddy production technologies helped to increase the output maximization and cost reduction. The major constraint were reported in paddy production technology were high cost of inputs, unawareness, and low price to produce.

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## Farm-size Efficiency Relationship in Punjab Agriculture: Evidences from Cost of Cultivation Survey

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### ABSTRACT

The study analyzes the resource use efficiency and identifies the determinants of technical efficiency of paddy, wheat and cotton crops in Punjab state using plot-level cost of cultivation survey data. The study established positive association between farm-size and efficiency in crop production. To improve the efficiency or to reduce the stress on farmers, present study is providing a strong evidence that if farmers would reallocate their input use, save a reasonable amount of money without reducing their output. The results identify that farm size and number of schooling years of head had a positive and significant relationship with efficiency; whereas number of fragments, age of family head, diversification index and bio-abiotic stress negatively influenced technical efficiency. The average potential for improvement in technical efficiency i.e. the yield gap in production is estimated as 26.95, 24.02 and 7.26 per cent in case of cotton, paddy and wheat respectively without increasing the input use.

### Keywords

Allocative efficiency, economic efficiency, farm size, productivity, Punjab, technical efficiency

### JEL Codes

C81, O13, Q13, Q18

### INTRODUCTION

In developing countries, nature and relationship of farm-size and productivity has been widely examined and intensively debated. The majority of studies on agricultural productivity during sixties and seventies support the view that there exists an inverse relationship between productivity and farm size (Sen 1962, 1964; Khusro, 1968; Rao, 1966; Saini, 1971; Berry & Cline, 1979; Barrett, 1996). The relationship between farm-size and efficiency is found to be non-linear, with efficiency first falling and then rising with size (Helfan & Levine 2004). High technical efficiency not only enables farmers to increase the employment of productive resources, but also gives a direction of adjustments required in the long-run to increase food production. Many studies conducted during 1980's questioned the inverse relationship between farm size and productivity arguing that the 'inverse farm size-productivity relationship' does not exist

anymore or has reversed over time, primarily due to the adoption of new agricultural technology (Chadha, 1978; Sen & Rudral, 1980; Bagai & Soni, 1983).

The present study revisits farm size-productivity debate in the state of Punjab, which is agriculturally the most advance and has three times larger land holding size than the national average of 1.15 hectare. The agricultural development in the Punjab state is clearly visible from the facts that it has the largest proportion of irrigated area (98 per cent), highest cropping intensity (about 190 per cent) and the most intensive use of chemical fertilizers (246 kg/ha) and other inputs during 2011-12 as compared to other states in the country. However, during the last decade state agriculture faced stagnation of agricultural productivity and profitability (Singh & Sidhu, 2006). The stagnation in agricultural productivity in the state has led to substantial rise in cost and put stress on farmers (Sidhu *et al.*, 2002; Singh *et al.*, 2013). The stagnation in

agriculture is mainly because the prevailing technology diffusion and use of modern inputs has reached its saturation point. Further, a strong tendency is developing among small and marginal farmers to lease out their land due to uneconomic holdings (Singh 2013). The present study explores scope to improve farm production without increasing the input use and examines farm size-efficiency relationship using plot-level representative cost of cultivation data. The study also identifies the factors influencing existing level of efficiency in crop production in Punjab.

**METHODOLOGY**

The study is based on plot-level data collected under “Comprehensive scheme for Cost of Cultivation (CCS) of Principal Crops” by Directorate of Economics and Statistics, Ministry of Agriculture for the state of Punjab. In the CCS, each sample household is surveyed consecutively for three years. For Punjab state, data is collected from 300 representative households of 30 tehsils. The sample households are equally distributed among five land-holding sizes viz. marginal (< 1 hectare), small (1-2 hectare), semi-medium (2-4 hectare), medium (4 - 6 hectare) and large ( > 6 hectare). The study used the latest available data pertaining to the block period 2008-09, 2009-10, and 2010-11. The analysis was done for three major crops namely paddy, wheat and cotton which together covered 86 per cent of the gross cropped area of the sample households. As efficiency is a farm-specific concept, plot level data were aggregated up to farmer level for the selected crops. Further, in order to have robust estimates, only those farmers were retained who grew the selected crops in all the three years and averages of input and outputs for each household were included in the data set. The final data set had 265 paddy growers, 300 wheat growers and 65 cotton growers.

This study used a two-step approach. In the first step, DEA technique was used to measure technical efficiency of farmers as an explicit function of discretionary variables. In the second step, farm-specific variables that are assumed to affect the efficiency of the farm are used in a Tobit regression framework to explain variations in measured efficiencies. A brief description of the DEA and Tobit model are given below:

*Data Envelopment Analysis approach (DEA)* is a well-established non-parametric method aiming to identify relative efficiency of Decision Making Units (DMUs) producing multiple outputs through the use of multiple inputs. The efficiency of a DMU is measured relative to all other DMUs with the simple restriction that all DMUs lie on or below an efficient frontier (Seiford and Thrall, 1990). DEA model based on the constant returns to scale (CRS)(Coelli.T. 1996) is stated as follows:

$$\begin{aligned} & \text{Min } \theta, \lambda\theta \\ & \text{Subject to } -y_i + y_i\lambda \geq 0, \\ & \theta x_i - X\lambda \leq 0, \\ & \lambda \geq 0, \dots \dots \dots \text{(Eq. 1)} \end{aligned}$$

where  $\theta$  is the scale of technical efficiency for

each farm,  $\lambda$  is as  $N \times 1$  vector of constants,  $y_i$  and  $x_i$  is the total output and farm inputs  $I, I = 1, 2, \dots, n$ . The value of  $\theta < 1$  indicates the level of production reflects the production frontier and technically efficient farms.

The DMUs are the individual sample farmers in this study. Yield was used an output while inputs used were labour use (hrs/ha), machine use (hrs/ha), irrigation (hrs/ha), seed quantity (kg/ha), fertilizers (Kg/ha) and their respective prices.

Technical efficiency is ‘the degree to which a decision making unit produces the maximum feasible output from a given bundle of inputs, or uses the minimum feasible amount of inputs to produce a given level of output’. These are two alternative definitions of technical efficiency leads to two measures known as output-oriented and input-oriented efficiency, respectively (Coelli *et al.*, 2002). On the other hand, allocative efficiency refers to ‘the ability to produce a given level of output using cost-minimising input ratios’. Both technical and allocative efficiencies are the components of economic efficiency which is the product of these two (Thiam *et al.*, 2001).

The study has also estimated yield gaps in production of crops using technical efficiency scores of the most efficient farms. Yield gap has been estimated as given by the formula:

$$\text{Yield gap (qtl/ha)} = [1 - (\text{average yield} / \text{potential yield})] * \text{average yield}$$

In the second stage, we used a censored regression to analyze the role of farm-specific attributes and demographic factors in explaining efficiency in production of crops. Since TE values are censored in the interval 0 to 1, Tobit model (Tobin, 1958) is employed. In the model, farm-specific characteristics and demographic factors were regressed against the efficiency scores obtained from DEA analysis. The standard Tobit model can be defined as follows for observation (farmer)  $i$ :

$$\begin{aligned} y_i^* &= x_i \beta + u_i \quad i=1, 2, \dots, n, \\ y_i &= y_i^* \quad \text{if } y_i^* > 0 \\ y_i &= 0, \text{ otherwise} \end{aligned}$$

where  $u_i \sim N(0, \Sigma^2)$ ,  $X$  and  $\beta$  are vectors of explanatory variables and unknown parameters, respectively. The  $y_i^*$  is a latent variable and  $y_i$  is the TE score. The functional form of the model is:

$$TE = \beta_0 + \beta_1 \text{NoF} + \beta_2 \text{hhsz} + \beta_3 \text{DivI} + \beta_4 \text{ownland} + \beta_5 \text{Age} + \beta_6 \text{Area} + \beta_7 \text{Bio-abiotic Stress} + \beta_8 \text{NSH} + \mu_i$$

Where, TE- technical efficiency  
NoF - Number of fragments;  
hhsz - house-hold size;

DivI- Simpson’s Diversification Index  $\{1 - (a_i/A_i)^2\}$ ; proportionate area of  $i^{\text{th}}$  crop in the gross cropped area;

ownland - proportion of owned land;  
Age- age of household head;  
Area- area under crop;  
Bio-abioticStress– Dummy for bio and abiotic

stresses which include drought, flood, irrigation seepage, human damage, animal damage, insect damage, disease, immature trees, wind, cyclone, and storm;

NSH- number of schooling years of head;

$\beta_0, \beta_{1-7}$  and  $\mu_i$  are constant, regression coefficients and error terms respectively.

## RESULTS AND DISCUSSION

### Performance of Crop Production in Punjab

Punjab is agriculturally the most advance state of the country. Presently, the average yield of paddy, wheat and cotton in Punjab is 1.60, 1.56, 1.40 times higher than national average, respectively (Table 1). During 2000 to 2010, growth rates in yield of paddy, wheat and cotton were 1.76 per cent, -0.17 per cent and 7.68 per cent, respectively. But, in the subsequent period between 2010 and 2014, growth in yield of these crops decelerated. The deceleration in yield in the state like Punjab poses a serious challenge to ensure food security in the nation.

**Table 1: The level and growth in crop yield**

Crop	Yield (kg/ha) in TE 2014-15		Growth rate in yield in Punjab (Per cent)	
	Punjab	India	2000-2010	2010-2014
Rice	3929	2423	1.76	0.60
Wheat	4678	3004	-0.17	-1.53
Cotton	702	486	7.68	-0.07

Source: Author's calculation based on Directorate of economics and statistics data

The results indicated varying pattern of crop production across land holding categories in the state. The farm-size group wise average yield and input use pattern in the selected crops are given in Table 2. The descriptive statistics clearly showed positive relationship between land holding size and crop productivity in the state. For instance, average yield of paddy varied from 58.25 qtl for marginal farmers to 61.23 qtl for large farmers during TE 2010-11. Similarly in case of cotton, large farmers realized about 40 per cent higher productivity than marginal farmers in the state. For wheat, although the productivity on large farms was higher, the yield difference was not substantial.

The examination of input use pattern revealed that marginal and small farmers employed more labour per hectare as compare to the large farmers. This could be because of engagement of family labour for farm operations on smaller land holdings. On the other hand, large farmer made higher use of machines than relatively smaller farmers. Similarly, fertilizer use was found to be higher among large farmers. It is interesting to note that farmers with smaller land holding put more irrigation than the large farmers while cultivating crops under consideration. However, the higher use of irrigation could not be translated into higher productivity, particularly among smaller farmers. This implies that small and marginal farmers use irrigation water more inefficiently than the large farmers. Almost all the sample farmers have

their own groundwater extraction devices (GEDs) and availability of free electricity gives no incentive to use groundwater rationally. Srivastava *et al.*, (2015) have reported that optimum level of groundwater use for paddy cultivation should be about 52 per cent less than the present level of 1.2 ha-metre, and groundwater use efficiency is higher among large farmers as compared to farmers with smaller land holdings. In the emerging scenario of over-exploitation of groundwater resources (Singh, 2011; Kaur *et al.*, 2015; Kaur & Vatta, 2015) urgent measures are needed to promote efficient use of groundwater in crop cultivation.

### Estimated Farm Efficiency in Crop Cultivation in Punjab

An input-oriented DEA model was used for estimating farm efficiency under the assumption of constant return to scale in cultivation of paddy, wheat and cotton. Table 3 presents estimated farm efficiency across farm-size groups. For paddy crop, mean technical, allocative and cost efficiency was found to be 72.4, 83.9 and 60.9 per cent, respectively. In case of wheat the estimated mean values of technical, allocative and economic efficiency were 82.0, 77.4, and 63.7 per cent respectively. The overall scores of technical, allocative and cost efficiency for the cotton crop were 78.1, 59.1 and 46.5 per cent, respectively. It is to be noted that in wheat and cotton allocative efficiency was lower than technical efficiency. This shows inability of the wheat and cotton growing farmers to use optimum mix of resources to minimise cost at a given level of output. In case of paddy, lower technical efficiency (than allocative efficiency) could be primarily because of inefficient and exploitative use groundwater resources for irrigation which is almost freely available to the Punjab farmers. As farmers do not incur any electricity charges in extracting groundwater, it results in higher value of allocative efficiency in paddy cultivation.

The results further revealed that farm efficiencies varied across farm-size categories. The average estimated efficiencies were relatively higher for large farmers in all the crops taken into consideration. This implies that large farmers in Punjab are more efficient in crop production and resources allocation as compared to the farmers with relatively smaller land holdings. Thus it can be concluded that even in the state with largest average land-holding size, there exists a potential to improve farm efficiency and productivity by increasing the size of the operational holding. These results provide strong evidences to implement land-reforms in Punjab as well as in the regions with similar production environment.

Categorization of sample farmers into efficiency classes provides valuable insights about variation in production technologies adopted by the farmers (Table 4). We categorised sample farmers into four efficiency classes; 1) < 40 per cent; 2) 40-60 per cent; 3) 60 to 80 per cent, and 4) > 80 per cent. It was found to be interesting that none of the farmers cultivating paddy and wheat, and

**Table 2: Crop wise average productivity and input use in Punjab across Land holding Size category, TE 2010-11**

Size group	Main Product (q/ha)	Labour	Machine	Groundwater irrigation	Seed (kg/ha)	Fertilizer (kg/ha)
<b>Paddy</b>						
Marginal	58.25	528	13	353	NA	195
Small	59.90	498	14	309	NA	201
Semi-medium	60.77	437	17	275	NA	202
Medium	60.80	423	17	242	NA	203
Large	61.23	413	18	234	NA	204
Over all	60.27	456	16	279	NA	201
<b>Wheat</b>						
Marginal	42.42	283	15	61	106	240
Small	42.09	227	16	53	106	245
Semi-medium	42.50	185	17	53	105	243
Medium	42.73	131	17	51	104	241
Large	43.32	115	16	51	104	244
Over all	42.61	188	16	54	105	243
<b>Cotton</b>						
Marginal	19.38	805	17	69	2	176
Small	20.12	708	17	60	3	168
Semi-medium	20.16	685	18	52	3	189
Medium	20.41	688	25	47	2	179
Large	27.09	767	30	45	2	220
Over all	21.46	734	21	58	3	187

Source: Author's calculation based on cost of cultivation plot level data for Triennium Ending (TE) 2010-11

**Table 3: Crop-wise average resource use efficiency in Punjab across farm-size categories, TE 2010-11**

Land holding size group	Technical efficiency	Allocative efficiency	Cost efficiency
<b>Paddy</b>			
Marginal	0.693	0.793	0.556
Small	0.729	0.815	0.587
Semi-medium	0.729	0.847	0.622
Medium	0.724	0.865	0.630
Large	0.741	0.862	0.639
Over all	0.724	0.839	0.609
<b>Wheat</b>			
Marginal	0.810	0.707	0.572
Small	0.809	0.728	0.591
Semi-medium	0.806	0.773	0.625
Medium	0.822	0.829	0.683
Large	0.841	0.850	0.715
Over all	0.820	0.774	0.637
<b>Cotton</b>			
Marginal	0.720	0.637	0.449
Small	0.764	0.577	0.441
Semi-medium	0.783	0.576	0.446
Medium	0.788	0.577	0.472
Large	0.855	0.579	0.496
Over all	0.781	0.591	0.465

Source: Author's calculation based on cost of cultivation plot level data for Triennium Ending (TE) 2010-11

only 5 per cent of farmers cultivating cotton had less than 40 per cent technical efficiency. More than 80 per cent of paddy and cotton growers and 97 per cent of the wheat growers were having technical efficiency score of more than 60 per cent. As in DEA analysis, efficiency scores of individual farm is compared with the farms at the frontier level, skewed distribution towards higher efficiency level indicates higher degree of homogeneity in production technology among the sample farmers of the state.

We have quantified gap between current and potential yields of three crops using technical efficiency scores of the most efficient farms (Table 5). The existing average yield for cotton, paddy and wheat was found to be 21.46, 60.27 and 42.61 qtl/ha, respectively. The results revealed that there exists a sizeable yield gap in the major crops in the state. A perusal of Table 5 indicates that the average potential for improvement in technical efficiency in cotton production is 5.78 qtl/ha with a yield gap of 26.95 per cent. In case of paddy and wheat average yield gap estimated to be 24.02 and 7.26 per cent, respectively. This implies that the average farmers could enhance crop production considerably with the existing level of technology and resources. This provides sufficient evidences on existing potential to increase crop production by narrowing the yield gap which will further contribute positively in ensuring food security in the nation and also helpful in reducing stress of farmers of the state.

It is to be noted that in Punjab, level of input use is

**Table 4: Crop wise farmer's frequency distribution and summary statistics of technical efficiency**

Technical efficiency (Per cent)	Paddy	Wheat	Cotton
Less than 40	-	-	3
40 to 60	51	9	7
60 to 80	140	123	18
Above 80	74	168	30
Total number of framers	265	300	58
Maximum efficiency	1	1	1
Minimum efficiency	0.414	0.433	0.271
Mean efficiency	0.724	0.820	0.781

Source: Author's calculation based on cost of cultivation plot level data for Triennium Ending (TE) 2010-11

Figures in parentheses are the percentage of total farmers

**Table 5: Average and potential yield for productivity improvement**

Crop	Average yield	Potential yield	Yield gap (q/ha)
Cotton	21.46	29.38	5.78
Paddy	60.27	79.32	14.47
Wheat	42.61	45.95	3.09

Figures in parentheses are the percentage

higher than other states in the country and use of modern inputs has reached its saturation point which necessitates chalking out the ways to improve technical efficiency without increasing input-use. Thus an understanding of farm level inefficiencies in production and identification of underlying determinants would provide the insights to make these crops more efficient and economically viable.

#### Determinants of Technical Efficiency of Farmers

The determinants of technical efficiency in crop production were identified by regressing technical efficiency scores with demographic and farm specific variables in Tobit model framework. The estimates of the Tobit regression coefficients for paddy, wheat and cotton crops are presented in Table 6.

As indicated from the Table 6, factors such as number of fragments of land holding, age of family head, diversification index and bio-abiotic stress negatively influenced technical efficiency, whereas farm size and number of schooling years of head showed a positive and significant association with efficiency. It is worth mentioning that effects (direction and level) and significance of all of these factors were not found to uniform across the crops taken into consideration.

The results revealed that one of the important determinants of inefficiencies is the fragmented structure of farm lands, especially in case of cotton. As expected, number of fragments had a negative impact on technical efficiency. Land fragmentation results in inconvenience in agricultural management and leads to inefficient use of

**Table 6: Tobit estimation of determinants of efficiency**

Variables	Paddy	Wheat	Cotton
Constant	1.1113*** (0.1309)	1.1381*** (0.0778)	0.2790 (0.3348)
No. of fragments	0.0158 (0.0142)	-0.0128 (0.0093)	-0.2195*** (0.0503)
House hold Size	0.0003 (0.0047)	0.0038 (0.0033)	0.0245 (0.0173)
Age of household head	-0.0014 (0.0009)	0.0000 (0.0006)	-0.0103*** (0.0034)
Diversification index	-0.6140*** (0.1609)	-0.4405*** (0.1000)	1.6807*** (0.4786)
Proportion of owned land	0.0774 (0.0521)	0.0262 (0.0327)	-0.0642 (0.1324)
Area under crop	0.0166*** (0.0047)	0.0120*** (0.0030)	0.0014 (0.0141)
Bio-abiotic stress	0.0246 (0.0209)	-0.1040*** (0.0145)	-0.2895*** (0.0592)
No. of schooling years of head	-0.0010 (0.0024)	0.0009 (0.0016)	0.0295*** (0.0075)
No. of farmers	265	300	58
Log likelihood function	156.841	313.115	52.360

\*\*\*, \*\*, and \* significant at 1, 5, and 10 per cent level

inputs in crop production. Thus consolidation of fragmented land holding will go a long way to improve farm efficiency. The impact of farmer's age may vary depending on whether aged farmers are more experienced or slower in adopting new technology than the younger farmers. The tobit analysis captured negative and significant effect of age of family head on efficiency of cotton cultivation. Thus indicates that the younger farmers are more likely to tap the scientific knowledge in cotton cultivation. Where as it has no significant impact on paddy and wheat grower's efficiency. Number of schooling years of head i.e. the level of education positively contributed to efficiency level of cultivators.

Crop diversification has positive and significant effect on technical efficiency of cotton producers while it has negative influence on the efficiency of paddy and wheat cultivators. As expected, area under crop has a positive association with farm efficiency (Table 6). The coefficient indicated that the large farms were more technically efficient than the small farms. Further, it has been noticed from the table 4 that the bio-abiotic stress has significant negative influence (cotton and wheat) on efficiency.

#### CONCLUSIONS

The present study analyzes the farm efficiency and identifies the factors affecting the efficiency of paddy, wheat and cotton crops in Punjab using the cost of cultivation survey data for the period during 2008-09 to 2010-11. It is found that large farmers were more

technically efficient than the farmers with smaller land holdings in all selected crops. This implies presence of economy of scale in the Punjab state. Results show that large farmers have relatively made higher utilization of machines and fertilizers per hectare and used relatively less labour. On the other hand, marginal and small farmers applied more irrigation hours per hectare as compared to medium and large farmers leading to inefficient and injudicious use of groundwater resources. Overall, the results suggest that efforts should be extended to increase operational land holding through consolidation of fragmented land-holdings and tenancy reforms to improve crop yield.

The study highlights scope for substantial improvement in crop yield without increasing physical use of inputs through efficiency improvement. The number of fragments, age of family head, diversification index and bio-abiotic stress negatively influenced farm efficiency, whereas farm size and number of schooling years of head showed a positive and significant relationship with efficiency. However, the effects of these factors varied across different crops taken into consideration.

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## How Efficient are Our Paddy Farmers? An Economic Analysis of Technical Efficiency and Changing Cost Structure in Paddy Production Across Indian States

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### ABSTRACT

The paper attempts to estimate the plot level technical efficiency of paddy farmers across the major paddy producing states in India using stochastic frontier production function. The technical efficiency was estimated for the all major rice-growing states for two different time periods (2003-04, 2012-13) using data from the Comprehensive Scheme on Cost of Cultivation of Principal Crops. Rice production with more than 80 per cent technical efficiency was observed in Odisha, West Bengal and Tamil Nadu. It was observed that the realized output could be increased by more than 10 per cent by enhancing the efficiency without any additional inputs. Agriculturally advanced states showed a declining trend in the yield implying an increasing pressure on rice production ecosystems due to continuous, intensive cultivation practices. The decadal changes in cost of cultivation of rice at constant prices (TE 2004-05 and TE 2012-13) were computed across the states and it varied from a maximum increase of 27.51 per cent in West Bengal to a minimum of 10.30 per cent in Punjab.

### Keywords

Cost of cultivation, paddy, stochastic frontier production function, technical efficiency

### JEL Codes

C13, C22, D20, D24

### INTRODUCTION

Agriculture has undergone tremendous changes in the past century, with agricultural research investments paving the way for productivity gains leading to reduction in production costs and capacity to cater larger population (Guptha *et al.*, 2014). With the rising population and their increasing needs, the country faced a major challenge to cater the needs of rising population and also to attain self-sufficiency in food grains. Hence, there was a rise in both public and private investments to increase the production of food grains through use of high yielding varieties, crop input management and new input management technologies. Since rice and wheat is the staple food crop of India, a majority of the investments and interventions were focussed on these crops especially paddy which solely comprises 36 per cent of the area under food grains and contributes to 40 per cent of the food grain production.

With the favourable circumstances like availability of a price support system from the Government, HYVs, fertilizers and irrigation facilities, the paddy cultivation system has turned out to be the most widespread and profitable one. Because of the growing pressure of increasing and maintaining the food grain production levels, the paddy cultivation progressively turned out to be an input intensive one leading to the rising costs of cultivation. Hence rice cultivation in India is an input intensive one with a high production. The total food grain production in India was 265.04 MT in 2013-14. But does the increasing production indicate an increasing efficiency? Theoretically, higher the use of inputs leads to a higher production, but efficiency in economic terms is not just about the rising production. Economically, efficiency is the economic state in which every resource is optimally allocated in the best way while minimizing waste and inefficiency. And technical efficiency is the

effectiveness with which a given set of inputs is used to produce an output. So now the query is whether the paddy production in India is technically efficient or is the resources over exploited to increase the production?

The specific objectives of the study are:

- a. to analyse the past trends and recent scenario in area and yield among major paddy producing states,
- b. to analyse the changing pattern of cost of paddy cultivation, and
- c. to estimate and compare the technical efficiency of paddy in major paddy producing states

## DATA AND METHODOLOGY

### Data

Secondary data were collected on cost of cultivation of paddy across 10 major rice producing states in India from Commission for Agricultural Costs and Prices ([eands.dacnet.nic.in/](http://eands.dacnet.nic.in/)) for the TE 2004-05 and 2012-13. Data on area, production and productivity of paddy in major rice producing states were collected from [www.indiastat.com](http://www.indiastat.com) for the years 1981-2014 to analyse the trends in paddy cultivation. Cross-sectional data on quantity and costs of various inputs used in paddy production across major rice producing states were also collected to estimate the technical efficiency across states and the changes in real costs of cultivation were also calculated.

The compound annual growth rate in area, production and productivity was calculated decade-wise for 1980s, 1990s and 2000s. Cost of cultivation (Cost A<sub>i</sub> and operational costs) was compared in real terms for 2004-05 TE and 2012-13 TE using the WPI deflator. The technical efficiency across the states was estimated for the year 2012-13 and was compared with the technical efficiency a decade back (2004-05) to understand the utilisation of resources.

### Analytical Framework

#### Compound growth rate (CGR)

Compound growth rates were worked out using the following method:

$$Y_t = a b^t$$

where,

Y<sub>t</sub> = dependent variable for which growth rate was estimated (area, yield and production)

a = intercept

b = regression coefficient,

t = years which take values 1, 2, ..., n

$$\ln Y = \ln a + t \ln b$$

$$\ln Y = \alpha + \beta t \text{ where } \alpha = \ln a, \beta = \ln b$$

Compound growth rate, CGR = (antilog β - 1) \* 100

#### Stochastic frontier production function

The present study uses the stochastic frontier production function approach to measure the technical efficiency in paddy production. In the analysis of farmer efficiency/ inefficiency, it is not the average of observed relationships between farmers' inputs and outputs that is

of interest but the maximum possible output that is obtainable from a given combination of inputs (Shanmugam, 2000). Thus, Frontier production function can be defined as the maximum feasible or potential output that can be produced by a firm with a given level of inputs and technology (Battese & Coelli, 1992; Sekhon *et al.*, 2010; Mythili & Shanmugam, 2000; Shanmugam & Venkataramani, 2006).

The general specification of stochastic frontier production function of Cobb-Douglas type is in logarithmic form is as:

$$\ln Y = \beta_0 + \beta_1 \ln (\text{Area}) + \beta_2 \ln (L) + \beta_3 \ln (M) + \beta_4 \ln (\text{Seed}) + \beta_5 \ln (\text{FERT}) + V_i - U_i$$

where,

Y = rice yield (in kg) L = total human labour (in hours) M = total machine labour (in hours) FERT = quantity of fertilizer (kg of NPK) Seed = quantity of seeds (in kg.) Area = Crop area (in hectares) V<sub>i</sub> -U<sub>i</sub> are the random errors.

The technical efficiency of the i<sup>th</sup> farmer can be calculated as:

$$TE_i = \exp (-\mu_i)$$

The technical efficiency of a farmer is between zero and one and is inversely related to the level of the technical inefficiency effect (Goyal and Suhag, 2003). The technical efficiency can be predicted using the Frontier programme 4.1 which calculates the maximum-likelihood estimators of the predictor for the above equation that is based on its conditional expectation (Battese, 1992; Shanmugam & Palanisamy, 1993).

## RESULTS AND DISCUSSION

### Trends in Paddy Area and Yield Across Major Paddy Producing States (1985-2014)

The trends in paddy area during the period 1985- 2014 are presented in Table 1. The highest area under paddy is observed for the states of Uttar Pradesh and West Bengal. States viz., Uttar Pradesh, Punjab, Haryana, Karnataka and Maharashtra show an increasing trend in paddy area while Kerala, West Bengal, Tamil Nadu and Orissa show a declining trend. The states with positive growth rates are composite Andhra Pradesh and Haryana (2.46 and 2.40 respectively) which are significant at 1 per cent level. Across the decades, the area under paddy is declining. States like Kerala (-4.20) and Tamil Nadu (-0.03) shows negative growth rates in both 1990s and 2000s.

States with positive growth rates are composite Andhra Pradesh, Haryana, and Punjab while Kerala, Orissa and Tamil Nadu states recorded negative growth rates. Most of the agriculturally advanced states are showing positive trends while the negative trend in Kerala is mainly due to increasing wage rates and the declining area in Tamil Nadu is primarily due to higher risk of droughts. The trends in paddy productivity (Table 3) reveals that agriculturally advanced states viz., Punjab and Haryana have recorded the highest yield, even though these states have shown a deceleration in yield growth rate possibly due to increasing pressure of production

**Table 1: area under paddy across major producing states (quinquennial average)**

	('000 ha)									
Year	AP	Har	Kar	Ker	Mah	Ori	Pun	TN	UP	WB
1985	3715.2	534.0	950.4	746.6	1516.6	4255.8	1485.6	2296.2	5314.2	5074.8
1990	3808.6	594.2	1162.2	596.6	1508.6	4303.6	1847.2	1934.6	5309.4	5580.0
1995	3683.4	744.2	1304.0	512.3	1544.1	4506.3	2151.2	2157.5	5479.8	5826.6
2000	4036.4	992.8	1414.5	372.4	1493.8	4489.7	2434.8	2190.6	5816.0	5838.2
2005	3338.0	1005.8	1287.9	297.2	1522.2	4445.0	2584.0	1779.3	5630.7	5866.9
2010	4108.2	1155.2	1470.4	234.9	1522.6	4389.5	2719.8	1880.7	5704.2	5583.3
2014	4026.7	1226.0	1344.7	201.7	1571.0	4069.2	2838.0	1707.5	5930.0	5463.9

AP: Composite Andhra Pradesh, Har: Haryana, Kar: Karnataka, Ker: Kerala, Mah: Maharashtra, Ori: Orissa, Pun: Punjab, TN: Tamil Nadu, UP: Uttar Pradesh, WB: West Bengal

**Table 2: CGR of paddy area across major paddy producing states**

States	1990-2000	2001-14
Composite Andhra Pradesh	1.47	2.46**
Haryana	6.09***	2.40***
Punjab	2.72***	1.14***
Karnataka	1.51***	1.02
Uttar Pradesh	1.23***	0.3
Maharashtra	-0.50***	0.24
Tamil Nadu	-0.09	-0.03
Odisha	-0.05	-0.78***
West Bengal	0.05	-0.93***
Kerala	-5.72***	-4.20***
<b>India</b>	<b>0.78***</b>	<b>0.13</b>

\*\*\* and \*\* Significant at one and five per cent level, respectively

levels on soil and water resources due to continuous cultivation. The green revolution of 1960s made these states to be agriculturally forward with the average yield of 3-4 tonnes per ha in Punjab as well as Haryana. While agriculturally less developed states like Odisha and Karnataka show a high growth rate of 3.01 and 1.06 respectively since their productivity levels are lesser initially.

#### Analysis of Cost of Cultivation

The decadal changes in cost of cultivation of paddy were calculated for TE 2004-05 and TE 2012-13. The

costs were deflated using wholesale price index (WPI) so as to work out the changes in real costs. The study showed that the real cost of cultivation has increased over the decade across all major paddy producing states while the percentage change has been the highest in the case of composite Andhra Pradesh (27 per cent) followed by West Bengal (26 per cent) and Tamil Nadu (21 per cent). From Table 5, it can be inferred that states like Haryana and Punjab have recorded relatively lesser change in cost mainly because these are agriculturally advanced states

**Table 4: CGR of paddy yield across major paddy producing states**

States	1990-2000	2001-14
Odisha	-2.93**	3.01**
Kerala	1.06***	1.91***
Uttar Pradesh	1.98***	1.86***
Maharashtra	0.37	1.75
Tamil Nadu	1.59	1.73
Haryana	-1.44	1.21**
Karnataka	1.49***	1.06
West Bengal	1.42***	0.86***
Punjab	0.12	0.76***
Composite Andhra Pradesh	1.59***	0.64
<b>India</b>	<b>1.08***</b>	<b>1.95***</b>

\*\*\* and \*\* Significant at one and five per cent level, respectively

**Table 3: Yield under paddy across major producing states (quinquennial average)**

	(kg/ ha)									
Year	AP	Har	Kar	Ker	Mah	Ori	Pun	TN	UP	WB
1985	2091.6	2561.4	1923.0	1683.6	1445.0	999.0	3083.2	2107.2	1252.6	1349.2
1990	2287.4	2537.6	1979.4	1794.0	1420.4	1165.4	3200.2	2936.0	1602.6	1777.2
1995	2495.2	2649.6	2342.0	1982.6	1543.4	1386.0	3334.0	3052.8	1827.0	2047.2
2000	2674.0	2589.0	2491.6	2072.0	1602.8	1150.6	3373.4	3264.4	2071.6	2240.2
2005	2926.6	2823.4	2661.2	2193.8	1605.0	1365.6	3710.0	2622.4	1986.4	2512.8
2010	3134.1	3024.4	2561.5	2445.5	1669.0	1591.6	3949.4	3006.5	2062.3	2576.9
2014	3080.6	3190.6	2697.1	2620.1	1913.0	1695.0	3896.9	3243.4	2421.4	2745.1

AP: Composite Andhra Pradesh, Har: Haryana, Kar: Karnataka, Ker: Kerala, Mah: Maharashtra, Ori: Orissa, Pun: Punjab, TN: Tamil Nadu, UP: Uttar Pradesh, WB: West Bengal

**Table 5: Decadal change in real cost A<sub>1</sub> across states**

States	(₹ per ha)		
	TE04-05	TE12-13	Per cent change
Composite Andhra Pradesh	15052.28	20764.64	27.510
West Bengal	12274.54	16638.28	26.227
Tamil Nadu	18891.04	23958.11	21.150
Orissa	9275.183	11677.28	20.571
Kerala	18690.4	23232.34	19.550
Karnataka	17321.69	21341.23	18.835
Uttar Pradesh	9885.714	12122.17	18.449
Maharashtra	16896.68	19740.04	14.404
Haryana	15236.3	17386.15	12.365
Punjab	13363.41	14898.3	10.302

Source: Authors own calculations

and hence recorded higher input use and costs in the base period itself.

Majority of the states have a decadal change ranging from 15- 20 per cent, implying that the cost of cultivation has increased with the increased use of inputs in order to raise the production levels. To analyse the shares of each input in the cost of cultivation, the percentage change in the operating cost of cultivation was analysed and the contribution of each factor are presented in Table 6.

Except the cost of animal labour, almost all other factor costs have increased across the paddy producing states. The share of human labour in cost of cultivation has increased in all the states except in Kerala (-6.8 per cent), where the introduction of MGNREGA has reduced the expenditure on human labour and the state has also witnessed a tremendous rise in share of machine labour (149.1 per cent). The share of animal labour in all states is on a decline but for states like Uttar Pradesh (38.1 per cent) and Haryana (25.5 per cent).

The share of machine labour is increasing in all the states except in Punjab and Haryana, since the states have recorded a higher level of mechanization in the base period of our analysis and hence the scope for further increase has been limited. The other variable inputs like seed and fertilizers and manures are have recorded an increased share in the operating cost. The share of

fertilizer in the states is also showing an increasing trend except in Haryana (-18.3 per cent), Maharashtra (-7.1 per cent) and Punjab (3.6 per cent). The share of insecticide in total operating cost of paddy production in Kerala has shown a tremendous increase (332 per cent) and the share of irrigation charges (25453.3per cent) in the operational cost has also increased manifold in this state. The share of irrigation cost in total cost of cultivation has declined in Punjab, Haryana and Tamil Nadu mainly because of the huge subsidies provided for electricity and water in these states.

#### Technical Efficiency in Rice Production

The maximum-likelihood estimates of the parameters in the Cobb-Douglas stochastic frontier production function are presented in Table 7. All the factor inputs used in the stochastic frontier production function have positive signs and are statistically significant at 5 per cent level, except human labour. The negative sign for the regression coefficient of human labour shows that the resource is being over utilised. The positive signs of the factors like area, machine labour, seeds and fertilizer indicate that there are chances of increasing productivity by using these inputs.

**Table 7: ML estimate of stochastic frontier function for paddy in Tamil Nadu**

Variable	Parameter	MLE	SE MLE
_cons	b <sub>0</sub>	3.16***	0.25
Area	b <sub>1</sub>	0.77***	0.04
L	b <sub>2</sub>	-0.06**	0.03
M	b <sub>3</sub>	0.07***	0.01
Seed	b <sub>4</sub>	0.03**	0.02
FERT	b <sub>5</sub>	0.19***	0.03
	σ <sup>2</sup>	0.10***	0.01
	Γ	0.83***	0.03
	M	0	-
	H	0	-
	Log likelihood	84.68	-
<b>Mean technical efficiency</b>			<b>0.811</b>

Source: Authors' estimates

**Table 6: Relative change in input shares of operational cost across states between TE 2004-05 and TE 2012-13**

Inputs	(Per cent)									
	AP	Har	Kar	Ker	Mah	Ori	Pun	TN	UP	WB
Human labour	56.1	47.6	36.6	-6.8	71.7	56.7	64.0	32.5	36.8	56.4
Animal labour	-45.0	25.5	-18.0	-0.2	-20.5	15.3	-30.8	-69.7	38.1	-40.9
Machine labour	91.0	-14.0	79.7	149.1	6.9	38.8	-0.8	46.9	43.0	106.0
Seed	23.3	12.1	59.2	30.2	8.1	11.2	47.3	91.4	24.9	39.6
Fertilizer and manure	11.7	-18.3	1.4	17.6	-7.1	13.0	-3.6	24.8	28.6	36.5
Insecticides	10.7	-5.8	15.6	332.1	147.8	-56.0	37.9	66.8	130.8	56.5
Irrigation charges	-23.6	28.3	-53.0	25453.5	270.0	-24.2	-48.5	-22.5	-5.4	25.1

Source: Authors own calculations

**Table 9: Frequency distribution of farms under efficiency categories across states (2012-13)**

MTE level	AP	Har	Kar	Ker	Mah	Ori	Pun	TN	UP	WB
<0.60	113	4	3	87	6	26	63	36	45	40
0.61-0.80	354	63	37	163	56	188	210	207	330	615
0.81-1.00	367	104	52	137	100	617	237	433	409	1220
<b>Total</b>	<b>834</b>	<b>171</b>	<b>92</b>	<b>387</b>	<b>162</b>	<b>831</b>	<b>510</b>	<b>676</b>	<b>784</b>	<b>1875</b>

AP: Composite Andhra Pradesh, Har: Haryana, Kar: Karnataka, Ker: Kerala, Mah: Maharashtra, Ori: Orissa, Pun: Punjab, TN: Tamil Nadu, UP: Uttar Praesh, WB: West Bengal

**Table 8: Mean technical efficiency across states**

States	2003-04	2012-13
Composite Andhra Pradesh	0.766	0.761
Haryana	0.725	0.814
Karnataka	0.961	0.810
Kerala	0.954	0.720
Maharashtra	0.620	0.713
Odisha	0.917	0.843
Punjab	0.850	0.772
Tamil Nadu	0.898	0.811
Uttar Pradesh	0.898	0.794
West Bengal	0.906	0.823

Source: Authors own calculations

The coefficients  $\mu$  and  $\eta$  are assumed to be equal to zero and the time-invariant frontier model is applied for the analysis to estimate the technical efficiency of the paddy farmers in Tamil Nadu from the representative sample of 676 farmers.

A production process is technically inefficient if maximum output is not produced from a given bundle of inputs. The mean technical efficiency is estimated to be 81.1 per cent for Tamil Nadu for the year 2012-13. The inefficiency may be contributed to various socio-economic factors or due to the under use of the inputs. Because of the large number of observations involved, the individual technical efficiency values are not presented. For better indication of the distribution of individual efficiencies, a frequency distribution of predicted technical efficiencies is shown in Table 9.

#### Mean Technical Efficiency Across States (2003-04 and 2012-13)

Comparing the mean technical efficiency across states (Table 8) showed that the technical efficiency is showing a decline across almost all the states except for states like Haryana and Maharashtra. Karnataka showed a tremendous decline in the technical efficiency from 0.961 in 2003-04 to 0.810 in 2012-13. The decline in technical efficiency in Kerala may be due to the rising wages of labour in the states which leads to rise in the cost of cultivation in the state.

The decline in technical efficiencies across state from 2003-04 to 2012-13 is mainly due to the underutilisation of the factors like human labour, seeds, area and fertilizer. From Table 9 we can infer that the technical efficiency of

majority of farmers in all the major paddy producing states is greater than 81 per cent. This implies that the farmers can improve the output by almost 20 per cent without additional resources through proper and more efficient use of the existing resources. The per cent of farmers above 80 per cent efficiency is seen in Orissa (74 per cent), West Bengal (65 per cent) and Tamil Nadu (64 per cent). This indicates that the farmers in these states are technically more efficient than other paddy producing states. The study also indicates that there is still a chance of improving the efficiency among the paddy farmers of India.

#### CONCLUSIONS

Overall there is an increasing trend in production and yield while the area of paddy is on the decline. States like composite Andhra Pradesh and Haryana show a significant positive growth in paddy area, production and productivity while Kerala, Tamil Nadu show negative growth. The real cost of cultivation has increased over the decade (increased use of inputs) and human labour, machine labour and irrigation charges have the major shares in the cost of cultivation. The mean technical efficiency of Tamil Nadu is 81.1 per cent, negative coefficient for human labour indicates its over use. The mean technical efficiency shows a declining trend from 2003-04 to 2012-13. Only Haryana and Maharashtra show an increase in mean technical efficiency over the decade.

#### POLICY IMPLICATIONS

To address the issues of increasing costs of inputs and the cost of cultivation, efforts focused on increasing the value of produce of paddy or the price realised by farmers are pathways of future. The increasing cost of inputs and the declining technical efficiency across the major rice producing states over time indicates the over exploitation of these areas and hence crop diversification policies should be implemented in these states. Various socio-economic and climatic factors as well may lead to changes in technical efficiency. An important policy to deal with bridging the gap between potential and actual yield may be through improving the extension advisory services and farmers' training on effective management rice crop production.

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## Impact of Forest Development Programme on Livelihood of Rural People in Nainital District of Uttarakhand

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### ABSTRACT

The present study was undertaken to overview the effects of FDPs in terms of income and employment generation and changes in nutritional pattern due to implementation of Forest Development Programme (FDP) in Nainital district of Uttarakhand. 20 households from 3 sampled villages were taken for the study and their experiences before and after implementation of FDPs were recorded with the help of well structured schedule. Inequality in the distribution of income for different income groups was estimated using Lorenz tools. The per capita per day nutritional value from the items they consumed were calculated using the conversion scale of the National Institute of Nutrition (NIN). The results revealed that After implementation of FDPs annual income of respondents increased, they were more occupied as FDP labours and were engaged in forest product collection, inequality in the income distribution also decreased as was evident from Lorenz curve, average per capita per day calorie consumption increased but was less than WHO's minimum requirement of 2400 Kcal. It was concluded that for sustainable benefit FDPs should give due importance to creation of rural assets and their maintenance.

### Keywords

Forest development programme, lorenz asymmetric coefficient, lorenz curve, nutrition

### JEL Codes

Q01, Q23, O13, E24

### INTRODUCTION

India is a green country, forestland occupies a little over 21 per cent of the country's total geographical area with moderately dense to very dense forests covering approximately 13 per cent of the land mass (Anonymous, 2011). Forest has been the source of mineral and nutrients since time immemorial. Productive lands are subjected to various degrees of degradation and fast turning into wastelands. Increasing population pressure, biotic pressure, unplanned urbanisation, breakdown of traditional institutions for managing common property resources and lack of proper management practices are some of the key reasons for land degradation.

Livelihoods are an outcome of how and why people organize to transform the environment to meet their needs through technology, labour, power, knowledge, and social relations. Sustainable livelihood concepts are increasingly being used by governments and international organizations, such as the World Bank through its

Community- Drive Development approach and its Rural Development Strategy.

DFID (Britain's Department for International Development) stresses that there are many ways of applying livelihood approaches but that there are six underlying principles to all these approaches, where in, poverty focused development activity should be people-centred, responsive and participatory, multi-level, conducted in partnership, sustainable and dynamic. Livelihood intervention is more than income enhancement.

National Afforestation Programmes (NAP), a flagship Forest Development Programmes under the aegis of National afforestation and eco-development Board (NAEB), Ministry of Environment and Forests, Government of India, is currently under implementation on a massive scale throughout the country by district level forest development agencies (FDAs). The overall objective of the programmes is ecological restoration and

environmental conservation through peoples' participation in conformity with the objectives as laid down in the National Forest Policy of 1988.

Nainital, was the first district in implementation of JFM programmes under National Afforestation Programmes in Uttarakhand (Sarin & Bisht, 2008). Different studies show that the deforestation rate within the district has decreased drastically and regeneration of forest is noticeable after the implementation of programmes and NGO efforts. But the programmes are found to have an overall impact on livelihood of forest dependent people. It becomes important to examine the impact of FDP on income and employment generation of rural household. At the individual level of the users, FDPs are gaining sufficient acceptance as intended but income generated from the programmes is not equally distributed among different classes of people.

Keeping this in view, it was planned to undertake a study in the Nainital district of Uttarakhand to estimate the extent of employment generated by the Forest Development Programmes and changes in the employment level after implementation of programmes and examine the change in nutritional pattern since the implementation of the programme.

**MATERIAL AND METHODS**

Nainital district of Uttarakhand was purposively selected as it was the first district in Uttarakhand where Participatory Forest Management programme/ Joint Forest Management programme under National Afforestation Programme had been launched and was one of the successful districts in implementation of Participatory Forest Management Programme in the state as reported by district forest office. Hence, the study is confined to this district.

Forest development programmes are going on in all the eight blocks of Nainital district. Out of the eight blocks, one block Bhimtal was selected randomly for the study. From the selected block Forest office, list of villages having forest development programmes such as NAP, NGOs implemented and JFM programme was obtained and out of them three villages, Jalna Neel Pahadi, Bahediya and Hediya were selected purposively as these are the villages that were completely covered under Forest Development Programmes.

The study pertains to agriculture year 2013-14. From each village, 20 beneficiaries were selected randomly. So, the total sample size comprised of 60 beneficiaries. These beneficiaries were asked about their experience of being a part of FDPs and the changes they have experienced before and after the implementation of programmes.

**Impact of FDPs on income distribution**

To measure the inequality in the distribution of income, Lorenz asymmetry coefficient was estimated for different income groups

**Lorenz curve**

Lorenz curve is the graphical tool to measure income inequality, using two spaced geometry developed by

economist Max Lorenz in 1905. In this graph, there is a line joining two opposite corners called perfect equality line. If any other line expressing actual distribution of income deviates from perfect equality line, it shows income inequality and the extent of deviation determines the extent of inequality.

**Lorenz Asymmetry Coefficient**

The Gini coefficient is only related to the size (area) and not the shape of the curve. Thus, the Gini coefficient does not contain all the information of the Lorenz curve. Different Lorenz curves can have the same Gini coefficient (Damgaard & Winer, 2000). Therefore, Damgaard and Winer, to characterize shape of the Lorenz curve, proposed a so-called "Lorenz asymmetry coefficient". The Lorenz asymmetry coefficient (S) shows which class (high income group or low income group) contributes most to the total inequality of the income. The coefficient (S) can be calculated from the n ordered data (X<sub>1</sub>,.....X<sub>m</sub>, X<sub>m+1</sub> ..... X<sub>n</sub>) of annual family income using the following equations

$$S = \frac{m + \delta}{n} + \frac{lm + \delta X}{ln}$$

$$\delta = \frac{\mu - X}{X_{m+1} - X_m}$$

Where, S=Lorenz Asymmetry Coefficient

- μ = Mean income level of the beneficiaries
- m =Number of individuals with an income less than
- lm = Cumulative income of individuals with an income less than
- ln = Cumulative income of all the individuals
- X<sub>m</sub> = Highest income of the individual with an income less than
- X<sub>m+1</sub> =Lowest income of the individual with an income more than

When S = 1, the Lorenz curve of the income is symmetric. When S > 1, most of the inequality within the income is due to the high income individuals and if S < 1, it indicates that the inequality in income is due to relatively large number of low income individuals.

**Change in Nutritional Pattern of Households**

In order to ascertain the change in nutritional pattern of the households, they were asked to recall their consumption pattern before and after the implementation of the programme. The per capita per day nutritional value from the items they consumed were calculated from the conversion scale of the National Institute of Nutrition (NIN).

**RESULTS AND DISCUSSIONS**

**Average expenditure pattern of respondents**

With the help of well designed schedule, expenditure of each household on various items such as consumption expenditure on necessity (food, cloth, and shelter), communication (mobile phone, land-line, and telephone booth), transportation, education, health, beverages and expenditure on forest produce was obtained. Thus,

obtained data was subjected to simple statistical tools like averages and per centage and thus average expenditure per household on various item was obtained for both the periods i.e. before and after the implementation of FDPs.

As can be seen from Table 1, average expenditure per household on necessities increased from ₹2150 to ₹3158 but per cent expenditure on consumption on necessities decreased from 22.51 to 15.81 per cent (by 6.7 per cent). Expenditure on communication network increased from 2.35 to 6.89 per cent i.e. by 4.54 per cent expenditure on transport and education increased by 11.37 per cent (difference of 16.60 and 5.3 per cent) and 14.03 per cent (26.59-12.56 per cent) respectively.

**Table 1: Per household distribution of respondents according to their average consumption expenditure**

Particulars	Before FDPs	After FDPs	Difference
	Average expenditure	Average expenditure	
Consumption on necessities	2150 (22.51)	3158.00 (15.81)	1008 (10.55)
Communication	225 (2.35)	1376.531 (06.89)	1151.531 (12.06)
Transport	500 (5.23)	3316.66 (16.63)	2816.66 (29.49)
Education	1200 (12.56)	5311.42 (26.59)	4111.42 (43.05)
Health	200 (2.09)	407.69 (2.04)	207.69 (2.17)
Beverages	1225	2049.091	824.091

*Figures in parentheses indicate percentage to total*

Expenditure on health more or less remaining the same, average expenditure on beverages showed an increasing trend but per cent expenditure decreased by 2.57 per cent (difference of 12.83 and 10.26 per cent). Moreover, results revealed that total expenditure on forest produce per household was somewhat equal before and after FDPs but per cent expenditure decline by 22.62 per cent.

#### **Annual family income particulars before and after forest development programmes**

##### **Source of income**

Average total family income after implementation of Forest Development Programmes includes income from crop enterprise, livestock enterprise, income from FDPs (includes both selling of forest products and labour generated) and others (includes services, business etc) in the study area. Total income from major crops grown during a period of one year is taken into consideration (for both the periods i.e. before and after implementation of Forest Development Programmes) for calculating total income from crop enterprise. All farmers of the area being selected were following subsistence agriculture.

Indigenous seeds remains from previous crops were used for cultivating next season crop. Moreover, none of the respondents were found to possess big machinery like tractors due to their marginal land holdings and hilly terrain. These big machineries were useless for them. Implicit labour i.e. own family labour was employed in all the respondents field hence the paid out cost were negligible.

The major livestock reared by the sample beneficiaries in both the periods were cow and buffalo. However, goats were also reared but not for milk, for meat purpose.

Forest Development Programmes besides providing Labour work for sample beneficiaries also provided tree samplings (both fruit and non-fruit), accessibility to government protected trees (prohibited forest) for lopping and collecting green leaves, dry leaves and fuel wood to the beneficiaries that saved their extra expenditure on green leaves, dry leaves and fuel wood. Other sources of income included remittances, pension, business, and services in the study area for both the periods.

The total income from different sources has been presented in Table 2 for both the periods i.e. before and after implementation of FDPs.

The perusal of Table 2 states that the annual gross income for crop enterprise was ₹10023.23 before FDPs which decreased to ₹4341 after implementation of FDPs. Hence, per cent share of gross income from crop enterprise out of total income decreased from 28.20 to 4.26 per cent. This trend is possible due to shifting of respondents to forest enterprise due to more remuneration from forest produce as compared to crop enterprises.

The total income from livestock enterprise increased from ₹9966.33 to ₹14733.33 but per cent share of livestock enterprise in total income witnessed a decline from 28.04 per cent to 14.41 per cent. This trend may be due to more relative increase in total income of beneficiaries as compare to increase in income from livestock.

Average annual income from forest produce increased from ₹9832.5 to ₹58808.83 after implementation of FDPs and per cent share showed a drastic increase from 27.66 per cent to 51.65 per cent. This increase in income from forest produce is attributed particularly to cultivation and selling of produce of Bamboo (*Bambusa vulgaris*) and Ringal (*Drepanostachyum falcatum*) that are fetching great remuneration after the implementation of FDPs due to their fast growing nature and great market demand of their produce. This trend can also be due to increase in access to forest areas and increase in forest plantation in beneficiaries own land.

Average annual income from labour also increased from ₹4120 to ₹28700 per household and per cent share in total income increased from 11.59 per cent to 28.07 per cent. This trend is because FDPs are providing compulsory work of 45 days for man and 30 days for

**Table 2: Distribution of respondents according to their source of income (average annual income) from different particulars**

		(₹)	
Particulars		Before FDPs	After FDPs
Source of income		Income Share	Income share
Agriculture		10023.33 (28.20)	4341 (4.21)
Livestock		9966.33 (28.04)	14733.33 (14.41)
FDP benefit	Forest produce	9832.5 (27.66)	52808.83 (51.65)
	Labour/Forest Development Programme	4120 (11.59)	28700 (28.07)
	Labour		
Others		1600 (4.5)	1600 (1.56)
<b>Total average income</b>		<b>35542.5 (100)</b>	<b>102233 (100)</b>

Figures in parentheses indicate percentage to total

women at a labour payment of ₹200 per day per man for and ₹100 per day per women (for work 6 hour approx) respectively. Moreover MGNREGA is also being implemented in the area and is linked to FDPs in one of the village being interviewed providing 100 days of work for at least one member per family at the prevailing labour wage of ₹140 per person per day.

**Annual family income across income groups before and after Forest Development Programme (FDPs)**

Any programme launched by the government mainly aims at empowerment of poor class people of the society. Forest development programmes running in different parts of India aims the same. In this section an attempt has been made to assess the impact of FDPs on different income groups of the beneficiaries. Numbers of beneficiaries in each group according to classification are discussed in Table 3.

As can be inferred from the given Table 3 that before FDPs majority of respondents were belonging to low income group (91.66 per cent) followed by middle income group (5per cent) and high income group (3.33 per cent) but after FDPs majority of farmers belong to middle income group (53.33 per cent) followed by low income group (40 per cent) and high income group (6.66 per cent). This trend clearly shows the improvement in income level of beneficiaries after implementation of FDPs.

**Impact of FDPs on employment**

This section is discussed in two sub-sections. The section 1 deals with employment generation (in terms of number of persons) through different sources before and after FDPs and the Section 2 is concerned with change in employment level of beneficiaries' household in terms of Man Equivalent Days (MED) after implementation of FDPs.

**Employment generation through different sources before and after FDPs**

The different sources of employment of beneficiaries' household in the study area were farming, livestock enterprise, FDPs generated labour, forest product collection and others (service, business). The impact of FDPs on employment generation of beneficiaries' household has been separately studied for both men and women. Number of men and women engaged in different occupations for both the periods i.e. before and after implementation of FDPs are presented in Table 4.

**Increase in employment in terms of total number of man days**

A keen look on Table 5 revealed that employment in terms of man equivalent days decreased for on farm work from 35173.33 MED to 11285 MED but for paid work it increased from 15391.6 MED to 137306.7 MED for all the sample villages.

**Income distribution among different beneficiaries of FDPs**

The impact of FDPs on income distribution has been examined for sample beneficiaries across income groups. Lorenz curve and Lorenz asymmetry coefficient have been used to examine the inequality of income distribution after implementation of FDPs across the income groups.

**Table 3: Distribution of respondents according to their annual income before and after the implementation of FDPs**

Particulars	Before FDPs		After FDPs		Net change in AFI
	Frequency		Particulars	Frequency	Frequency
low income (< 51500)	55 (91.66)		Low income (< 95000)	24 (40)	31 (51.67)
Medium income (51500-86500)	03 (05)		Medium income (95000-143650)	32 (53.33)	29 (48.33)
High income (> 86500)	02 (3.34)		High income (> 143650)	04 (6.67)	02 (3.34)

Figures in parentheses indicate percentage to total

**Table 4: Distribution of beneficiary households by occupation**

Particulars/Occupation	Before FDPs		After FDPs	
	Men	Women	Men	Women
Farming	57	128	47	112
Livestock	24	118	21	117
FDP labour	98	29	122	-
Forest product collection	108	48	127	157
Others	2	-	2	-

**Table 5: Particulars of total number of man equivalent days before and after FDPs**

Particulars	On farm work	Paid work
Before FDPs	35173.33	15391.6
After FDPs	11285	137306.7

**Lorenz curve**

Lorenz curve has been used to measure income inequality and the extent of inequality persistent in the sample beneficiaries before and after forest development programmes.

**Lorenz curve of annual family income for different income group of beneficiaries before and after implementation of FDPs**

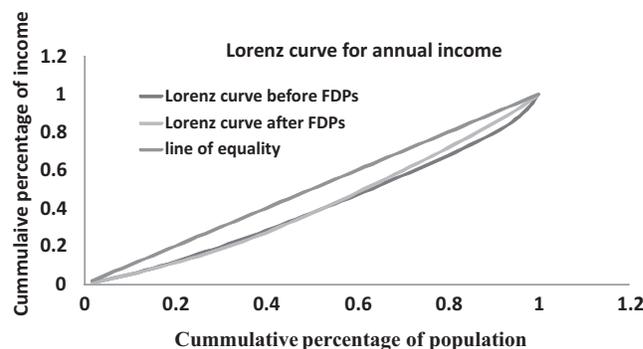
From Figure 1 it is clear that the Lorenz curve is little away from line of equality, showing persistence of level of inequality among beneficiaries of FDPs. Although, the Lorenz curve for annual family income of the beneficiaries after implementation of FDPs was nearer to line of equality than Lorenz curve before FDPs. This shows that the inequality in the income distribution decreased after FDPs. This might be due to increase in level of income of low income beneficiaries after implementation of FDPs.

**Lorenz curve for different income group of the beneficiaries**

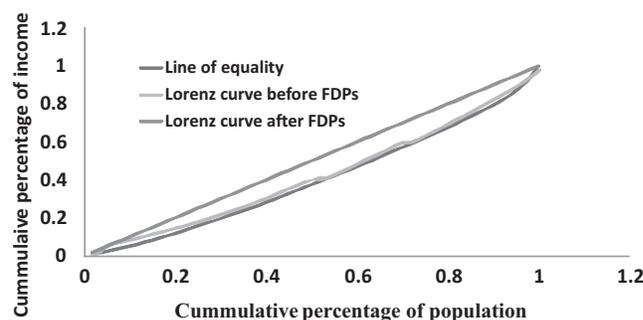
**Low income:** As evident from the Figure 2, the Lorenz curve has shifted towards line of equality after FDPs implementation. This shows that inequality was less after implementation of FDPs in the study area for low income group beneficiaries.

**Middle income:** As evident from the Figure 3 as the Lorenz curve has been shifted towards line of equality after FDPs. This shows that inequality was less after implementation of FDPs the study area for middle income group

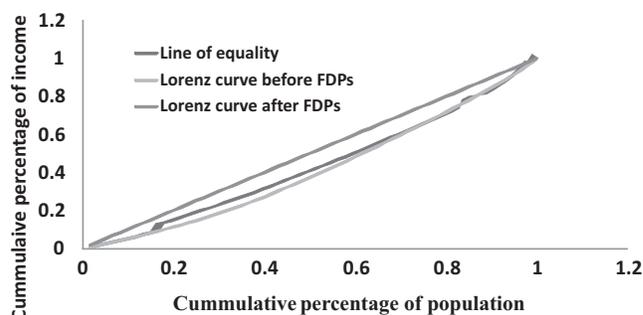
**High income:** In case of high income group, the Lorenz curve of the beneficiaries' household income before and after FDPs crossed at a point in between two extremes but Lorenz curve of beneficiaries' household income before FDPs was below the Lorenz curve of beneficiaries' household income after FDPs programme, in larger part of the curve. So, the inequality in income decreased after implementation of FDPs in the study area for high income



**Figure 1: Lorenz curve of annual family income of the beneficiaries before and after implementation of FDPs**



**Figure 2: Lorenz curve for low income group**



**Figure 3: Lorenz curve for middle income group**

group as well (Figure 4).

**Lorenz Asymmetry Coefficient (LAC)**

The Lorenz asymmetry coefficient for overall sample shows that Lorenz curve for income was asymmetric in both periods (i.e. before and after FDPs. The value of LAC is less than one ( $S < 1$ ) for the sample in both cases, before FDPs ( $S = 0.68$ ) and after FDPs ( $S = 0.89$ ) (Table 6).

This indicates that the inequality persistent in the beneficiaries' income is due to presence of large number of low income individuals.

**Change in Nutritional Pattern of Households**

The average per capita per day nutritional requirement of households were calculated using ICMR conversion scales and it was found that before

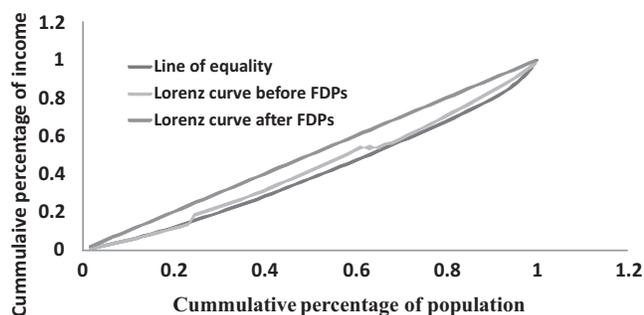


Figure 4: Lorenz curve for high income group

Table 6: Lorenz asymmetry coefficient for different income groups of beneficiaries before and after FDPs

Income group	Before FDPs	After FDPs
Low income group	0.88	0.79
Middle income group	0.79	0.82
High Income Group	0.84	1.34
Overall	0.68	0.89

implementation of the programme average per capita per day calorie consumption was 1680 Kcal which was increased to 1840 Kcal after the implementation of programme. However this figure is far less than the minimum consumption requirement for rural areas as stated by WHO (World Health Organisation) i.e. 2400 kcal per capita per day but it clearly emphasises upon the improvement this programme has made on nutritional pattern of rural masses. Earlier home grown food was in the main dietary habit of masses that included mostly coarse cereals like bajra, ragi and some pulses like black soyabean and 'jhingora' and leafy vegetables (mustard, spinach, raddish) however it was found that after implementation of programme; increased income of family endured them with whole grains like wheat and rice too. It also enabled family to buy some pulses from market and raised their living standard significantly.

### CONCLUSIONS

As on current date so many Forest Development Programmes are running in India such as National Afforestation Programmes (NAP) on a massive scale throughout the country by district level forest development agencies (FDAs). Besides that NGOs are also running Forest Development Programmes in Himalayan range for restoration and regeneration of forests. It has made many

achievements up to now like regenerating forests, increased production of forest products, access to forest for income generation, and financial support in livelihood improvement etc. It becomes important to examine the impact of FDPs on income and employment generation and nutritional pattern of rural households and thus a study in the Nainital district of Uttarakhand was conducted to focus on the aforesaid issues.

It was found out that average expenditure pattern increased after implementation of Forest Development Programme. Per cent share of gross income from crop enterprise out of total income decreased from 28.20 per cent to 4.26 per cent. This trend is possible due to shifting of respondents to forest enterprise due to more remuneration from forest produce as compared to crop enterprises. Average annual income from forest produce increased from ₹ 9832.5 to ₹58808.83 after implementation of FDPs and per cent share showed a drastic increase from 27.66 per cent to 51.65 per cent. The Lorenz curve for annual family income of the beneficiaries after implementation of forest development programmes has been found nearer to line of equality than Lorenz curve before forest development programs. The Lorenz asymmetry coefficient for overall sample showed that the inequality persistent in the beneficiaries' income was due to presence of large number of low income individuals both before FDPs (coefficient 0.68) and after FDPs (coefficient 0.89).

The average per capita per day calorie consumption was 1680 Kcal which was increased to 1840 Kcal after the implementation of programme, which is far less than the minimum consumption requirement for rural areas as stated by WHO, but it showed that the programme had made improvement in nutritional pattern of households.

The main beneficiaries of FDPs comprise disadvantaged and low income group of the society. Though empowerment of local people through income generating activities is one of the main objective of FDPs but creation of rural assets and their maintenance should be given due importance for sustainable and long term benefit of the poor rural households.

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## **Optimum Farm Plans for Tamirabarani River Basin in Tirunelveli District -A Multi Objective Programming Approach**

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### **ABSTRACT**

The present study aimed at developing the optimum plans under multi objective environment across scale of farming. A sample consisting of 180 farmers was drawn from the head and mid regions of Tamirabarani River basin of Tamil Nadu, India. Lexicographic goal programming was employed to develop the optimal farm plans. Lexicographic goal programming model attempted in the present study specifies the economic, ecological and equity goals of farming and ranks them according to their priorities and to satisfy the higher priority goals first before the attainment of lower priority goals. Six modal farms representing six farm situations were selected and six optimal farm plans were derived. The results of the normative planning exercised indicated that all the optimum plans derived could increase the economic goal of profit, ecological goals of reduction in intensive inputs usage and equity goal of employment generation in the farm households and there by the possibility of practicing sustainable agriculture in the region.

### **Keywords**

Farm plan, goal programming

### **JEL Codes**

Q12, C61

### **INTRODUCTION**

After remaining a food deficit country for about two decades since independence, India has not only become self-sufficient in food grains, but also has a surplus of food grains now. This change was made possible by the use of scientific agriculture practices which permitted higher and more stable food production and also ensured food stability and security for the millions in the country. Modern farm technologies have destroyed the natural habitat of most of the wild flora and fauna and also led to soil erosion, there by causing ecological imbalance. Also, modern agricultural production technologies consume large amounts of intensive of inputs in production making the soil less productive in long run. This situation warrants the use of sustainable agricultural production practices. Sustainable agriculture describes farming systems that are "capable of maintaining their productivity, and usefulness to society indefinitely. As quoted by Duesterhaus (1990), "such systems must be resource-conserving, socially supportive, commercially

competitive, and environmentally sound." For many analysts, the sustainability of agriculture can be described by the assessment of economic returns to farming. In commercial economies, farms which are unable to generate sufficient profits because of low farm product prices, reduced yields, higher costs of production, or for whatever reason, are not self-sustaining. Consequently, a requirement of agricultural sustainability is the existence of economic returns, which are sufficient to sustain farm businesses, and to adequately reward producers (Brklacich *et al.*, 1991; Repetto, 1987).

The growth in the production of agricultural crops depends on many factors such as area cropped, input management and yield. The cropped area and productivity are determined by the fertility of soil, monsoon behaviour, rainfall, irrigation, availability of agricultural labourers, climatic changes, and agricultural prices. Land degradation is one major constraint for sustainable production in India. Efficient and sustainable agricultural farm plans incorporating the economic,

ecological and equity goals are found more appropriate in addressing situational needs and more useful and meaningful in optimizing production and income along with the conservation of environment and equity by way of providing employment in any farm or region. The present study has been undertaken in Tamirabarani irrigation system in Tirunelveli district to develop normative sustainable farm plans in a multi-objective setting for optimizing production, profit and other farming goals in Tamirabarani River Basin. The study would bring out the sources of inefficiency in the production of crops along with constraining resources which would help the farmers in the reallocation of resources in Tamirabarani irrigation system. The optimum farm plans derived might help the farmers in the choice of appropriate crops, right production technologies and area allocation for such crops in their farms with efficient production and profitability.

## METHODOLOGY

### Study Area

Tamirabarani River passes through six agricultural divisions, of which Ambasamudram, Tirunelveli and Palayamkottai divisions fall under Tirunelveli district and the remaining three divisions fall under Thoothukudi district. As the present study is intended to evolve optimum farm plans for improving crop production in a river basin, the head and mid region of Tamirabarani river basin falling in Tirunelveli district was purposively selected. A two stage random sampling method was adopted to select the sample farms from the four blocks selected in head and mid reach of Tamirabarani river basin. At first stage, all the revenue villages were arranged in ascending order based on the gross cropped and three revenue villages per block were selected, thus constituting 12 selected revenue villages with the spread of six revenue villages. In the second stage 15 farmers were selected from each of the 12 selected revenue villages, thus constituting a total sample size of 180 farmers. Based on the homogeneity tests, the sample farms falling in each region were stratified in to small, medium and large farms, thus constituting 56 small farms, 18 medium farms and 16 large farms in head region, and 50 small farms, 25 medium farms and 15 large farms in middle region. The variable such as cropping intensity, size of holdings, human labour utilization, manure, water and capital requirements in these the six categories were listed individually for each group and the mean of the above listed variables was worked out for each category. Then, the farm which was close to the mean values of all the variables in each category was selected as the modal farm. The selected modal farm was used to derive optimum plans employing Lexicographic Goal programming models.

### Formulation of Lexicographic Goal Programming (LGP)

LGP model based on Romero & Rehman (1989) was employed to generate optimum farm plans under

alternative scenarios to ensure to improve crop production with respect to the goals. In LGP, the goals are ranked according to their priority and goals with higher priority are satisfied first and then lower priority goals were considered. The priority of goals as assigned by the individual farm operators for the six farm situations were considered for optimization under Lexicographic Goal programming models.

Minimize  $Z = \sum P_i (W_i^+ d_i^+ + W_i^- d_i^-)$  (achievement function)

Subject to constraints

$F_i(x) - d_i^+ + d_i^- = T_i$  (set of goals)

$x \in b$  (set of linear constraints)

$x, d_i^+, d_i^- \geq 0$  (Non-negativity constraints)

$d_i^+, d_i^- = 0$  (for all goals)

$W_i$  represents the weights attached to deviational variables.

$P_i$  assigned to  $i^{\text{th}}$  priority,  $i = 1, 2, \dots, m$  (number of objective)

$d_i^+, d_i^-$  is positive and negative deviation from the target goal ( $d_i^+$  over achievement and  $d_i^-$  under achievement)

let the parameters of the operational model for different categories of farms are defined as follows.

$X_j$  - area under  $j^{\text{th}}$  crop activity

Productive resources

LS = Total area of land currently under use for cultivating the crops 'C' in any season 'S' in hectares.

MH = Total machine hours available during the year expressed in hours

MD = Total Labour available during the year in man days equivalent

WS = Total amount of water available during the season 'S' expressed in hectare millimeter.

TF = Total amount of farm yard manure available during the year expressed in tonnes.

TNR = Total amount of nitrogen available during the year expressed in kilograms

TPHR = Total amount of phosphorus available during the year expressed in kilograms

TKR = Total amount of potash available during the year expressed in kilograms

T CPP = Total cash available per annum for purchase of plant protection chemicals in rupees.

TP = Total profit from all crop yield in different season in a year expressed in rupees.

Input coefficients

MHCS = Machine hours required for tillage per hectare of land for cultivating the crop 'C' during the season 'S' in hours.

MDCS = Labour required per hectare of land for the crop 'C' during the season 'S' in man days equivalent

WCS = Amount of water required per hectare of land for cultivating the crop 'C' during the

season 'S' in ha mm

FCS=Amount of Farm yard manure (in tonnes) required per ha of land cultivation under the crop 'C' during the season 'S' in kilograms.

NRCS=Amount of nitrogen (in kg) required per ha of land cultivation under the crop 'C' during the season 'S' in kilograms.

PHRCS=Amount of Phosphorus (in kg) required per ha of land cultivation under the crop 'C' during the season 'S' in kilograms.

KRCS=Amount of potash (in kg) required per ha of land cultivation under the crop 'C' during the season 'S' in kilograms.

CPP= Cash required for purchase of plant protection chemicals in rupees

WCCS= Working capital required per hectare of crop 'C' cultivated during the season 'S' in rupees.

MPCS= Profit per hectare of the crop 'C' cultivated during the season 'S' in rupees.

Then, the achievement function Z is minimized subject to the following operational goals and constraints.

Profit goal:

$$1) \text{MPCS } x_j d_1^- + d_2^+ = \text{MP} \quad \text{Total Profit goal}$$

Ecological goals:

$$2) \text{NRCS } x_j d_1^- + d_2^+ = \text{TNR} \quad \text{Nitrogen requirement goal}$$

$$3) \text{PHRCS } x_j d_1^- + d_2^+ = \text{TPHR} \quad \text{Phosphorus requirement goal}$$

$$4) \text{KRCS } x_j d_1^- + d_2^+ = \text{TKR} \quad \text{Potash requirement goal}$$

$$5) \text{CPP } x_j d_1^- + d_2^+ = \text{T CPP} \quad \text{Plant protection chemical goal}$$

**Social goal**

$$6) \text{MDCS } x_j d_1^- + d_2^+ = \text{MD} \quad \text{Employment goal}$$

**Constraints**

$$1) \text{MHCS } x_j \leq \text{MH} \quad \text{Machine use constraint}$$

$$2) \text{MDCS } x_j \leq \text{MD} \quad \text{Irrigation water use constraint}$$

$$3) \text{WCCS } x_j \leq \text{WS} \quad \text{Working capital requirement constraint}$$

$$4) \text{FCS } x_j \leq \text{TF} \quad \text{Farm yard manure requirement constraint}$$

$$5) X_j \geq \text{LS} \quad \text{Land use constraints}$$

In the present study, maximizing profit was taken as the economic aspect of sustainable agriculture. Minimizing usage of nitrogen, phosphorus, potash and cash requirement towards plant protection chemical were taken as the ecological goals. Maximizing employment goal was taken to capture the social equity. Land use, machine hours, farm yard manure, working capital availability and water requirement were taken as the economic constraints. The targets for the different goals

and constraints and input coefficients were taken from the modal farms selected.

**Selection of Real Activities**

The activities selected for the programming were paddy, banana, bhendi, brinjal, chillies, tomato, black gram and red gram. In addition to crop activities, hiring of labour in standardized man day equivalent of eight hours, machine hours, nitrogen, phosphorus, potash, water requirement, working capital and expected profit were also included in the model.

## RESULTS AND DISCUSSION

The optimum sustainable crop plan derived for small farms in head region showed an increase in the gross cropped area by 0.52 ha (30.23 per cent). The area under paddy and banana had increased by 0.20 and 0.20 ha, respectively. Chilly and black gram had entered as new crop enterprises into the optimum sustainable plan with the area of 0.03 and 0.09 ha, respectively. The optimal small farm plan derived for head region envisaged a reduction in the existing resource use by 2.14 kg of nitrogen (2.94 per cent), 0.33 kg of phosphorus (0.76 per cent), 0.21 kg of potash (1.30 per cent), cash expenses on plant protection chemicals by ₹405.97 (20.27 per cent) and 17.76 ha mm of water consumption (4.72 per cent), while in the case of inputs such as farmyard manure and machine power, it maintained the input usage as in the existing plan with neither a reduction nor addition, thus satisfying fully the ecological goals. The optimum plan created additional employment by 1.51 man days (2.15 per cent) than the existing plan and it increased the profit by ₹467.63 (5.04 per cent) and decreased the working capital requirement by ₹641.98 (1.94 per cent) when compared to the existing plan. The optimum plan derived for small farm in head region was economically efficient, socially equitable and ecologically sound.

The optimum sustainable plan derived for small farms in mid region indicated significant increase in the gross cropped area by 0.60 ha. The area under paddy decreased by 0.20 ha and the area under banana increased by 0.20 ha in the optimum plan when compared to existing plan. But the existing area under brinjal and tomato was maintained in the optimum plan. Chilly entered as a new crop enterprise with an area of 0.60 ha in the optimum sustainable plan. The optimum small farm plan for mid region envisaged a reduction in the existing resource use by 9.86 kg of nitrogen (11.41 per cent), 3.33 kg of phosphorus (6.18 per cent), 4.29 kg of potash (14.73 per cent), cash expenses on plant protection chemicals by ₹118.82 (15.51 per cent) and 70.00 ha mm of water consumption (8.14 per cent) farmyard manure reduced by 0.49 tonnes (6.91 per cent) and machine power usage by 0.02 hours (0.20 per cent) from the existing plan. The optimum plan created additional employment by 16.14 man days (2.15 per cent) than the existing plan and it increased the profit by ₹377.94 (2.88 per cent) and decreased the working capital requirement significantly by Rs.4640.99 (11.22 per cent) when compared to the

**Table 1: Optimum sustainable crop production plan for small farms in head region**

Activities/Resources	Existing plan	Optimum plan	Percentage change in area and resource allocation*
<b>Area under crops (ha)</b>			
Paddy	0.80	1.00	0.20
Banana	0.40	0.60	0.20
Chilly	0.00	0.03	0.03
Black gram	0.00	0.09	0.09
Gross cropped area	1.20	1.72	0.52 (30.23)
<b>Resource allocation</b>			
Machine power (hour)	6.36	6.36	0 (0.00)
Farm yard manure (tonnes)	4.60	4.60	0 (0.00)
Nitrogen (kg)	72.78	70.64	-2.14 (-2.94)
Phosphorus (kg)	44.59	44.25	-0.33 (-0.76)
Potash (kg)	16.33	16.11	-0.21 (-1.30)
Cash expenses on plant protection (₹)	2003.00	1597.03	-405.97 (20.27)
Employment (Man days)	70.14	71.65	1.15 (2.15)
Water consumption (ha mm)	1430.00	1412.24	-17.76 (-4.72)
Working capital (₹)	32989.74	32347.75	-641.98 (-1.94)
<b>Profit (₹)</b>	<b>9282.26</b>	<b>9749.89</b>	<b>467.63</b> <b>(5.04)</b>

Figures in parentheses indicate percentage change in existing plan to optimum plan

existing plan. The optimum plan derived for small farm in mid region was economically efficient, socially equitable and ecologically sound.

The optimum sustainable plan derived for medium farms in head region indicated significant increase in the gross cropped area by 0.63 ha (23.08 per cent). The area under banana and black gram has increased by 0.23 and 0.40 ha, respectively in optimum plan as compared to existing plan. The optimal medium farm plan derived for head region envisaged a reduction in the existing resource use by 13.71 kg of nitrogen (6.18 per cent), 5.49 kg of phosphorus (5.62 per cent), 2.34 kg of potash (4.39 per cent), cash expenses on plant protection by ₹291.36 (13.67 per cent) and 165.55 ha mm of water consumption (17.88 per cent) and the input usage in farmyard manure and machine power, thus satisfying fully the ecological goals. The optimum plan created additional employment

**Table 2: Optimum sustainable crop production plan for small farms in mid region**

Activities/Resources	Existing plan	Optimum plan	Percentage change in area and resource allocation*
<b>Area under crops (ha)</b>			
Paddy	0.60	0.40	-0.20
Banana	0.20	0.40	0.20
Brinjal	0.20	0.20	0.00
Tomato	0.20	0.20	0.00
Chilly	0.00	0.60	0.60
Gross cropped area	1.20	1.80	0.60 (33.33)
<b>Resource allocation</b>			
Machine power (hour)	8.90	8.89	-0.02 (-0.20)
Farm yard manure (tonnes)	7.15	6.65	-0.49 (-6.91)
Nitrogen (kg)	86.40	76.54	-9.86 (-11.41)
Phosphorus (kg)	53.81	50.48	-3.33 (-6.18)
Potash (kg)	29.15	24.86	-4.29 (-14.73)
Cash expenses on plant protection (₹)	766	647.18	-118.82 (11.64)
Employment (Man days)	42.72	58.86	16.14 (27.42)
Water consumption (ha mm)	1205	1023.60	-70.00 (-8.14)
Working capital (₹)	31606.23	36724.29	-4640.99 (-11.22)
<b>Profit (₹)</b>	<b>13139.00</b>	<b>13516.94</b>	<b>377.94</b> <b>(2.88)</b>

Figures in parentheses indicate percentage change in existing plan to optimum plan

by 10.14 man days (5.15 per cent) than the existing plan. It increased the profit by ₹456.63 (1.43 per cent) over the existing plan and decreased the working capital requirement by ₹348.69 (2.80 per cent) when compared to the existing plan. The optimum plan derived for medium farm in head region was economically efficient, socially equitable and ecologically sound.

The optimum sustainable crop plan derived for medium farms in mid region indicated a significant increase in the gross cropped area by 0.27 ha (7.78 per cent) when compared to existing plan. The existing area under banana and tomato was maintained in the optimum plan, but there was a reduction in the area of paddy by 0.13 ha. Black gram entered as new crop enterprises with area of 0.40 ha in the optimum sustainable plan. The optimal medium farm plan derived for mid region indicated an

**Table 3: Optimum sustainable crop production plan for medium farms in head region**

Activities/Resources	Existing plan	Optimum plan	Percentage change in area and resource allocation*
<b>Area under crops (ha)</b>			
Paddy	0.60	0.80	0.00
Banana	1.00	1.23	0.23
Black gram	0.30	0.70	0.40
Gross cropped area	2.10	2.73	0.63 (23.08)
<b>Resource allocation</b>			
Machine power (hour)	13.93	13.93	0.00 (0.00)
Farm yard manure (tonnes)	11.50	11.50	0.00 (0.00)
Nitrogen (kg)	221.82	208.12	-13.17 (-6.18)
Phosphorus (kg)	97.50	92.01	-5.49 (-5.62)
Potash (kg)	53.24	50.90	-2.34 (-4.39)
Cash expenses on plant protection (₹)	2131	1839.64	-291.6 (-13.67)
Employment (Man days)	196.97	207.11	10.14 (5.15)
Water consumption (ha mm)	2754.95	2580.40	-165.55 (-17.88)
Working capital (₹)	12432.56	12083.87	-348.69 (-2.80)
Profit (₹)	31806.66	32262.83	456.17 (1.43)

*Figures in parentheses indicate percentage change in existing plan to optimum plan*

additional resource requirement of 6.65 kg of nitrogen (2.24 per cent). The optimum plan envisaged a reduction in the existing resource use by 6.65 kg of phosphorus (4.88 per cent), 7.53 kg of potash (11.38 per cent), cash expenses on plant protection by ₹513.80 (39.40 per cent) and 185.21 ha mm of water consumption (22.27 per cent), while it maintained the input usage in farmyard manure and machine power, thus satisfying only three ecological goals. The optimal sustainable plan created additional employment by 12.28 (4.39 per cent) and it increased the profit by ₹864.77 (1.92 per cent) over the existing plan and decreased the working capital requirement by ₹1781.33 (1.41 per cent) when compared to the existing plan. The optimum plan derived for medium farm in mid region was economically efficient, socially equitable and ecologically not so sound.

The optimum sustainable plan derived for large farms in head region indicated a significant increase in the gross

**Table 4: Optimum sustainable crop production plan for medium farms in mid region**

Activities/Resources	Existing plan	Optimum plan	Percentage change in area and resource allocation*
<b>Area under crops (ha)</b>			
Paddy	2.00	1.87	-0.13
Banana	1.00	1.00	0.00
Tomato	0.20	0.20	0.00
Black gram	0.00	0.40	0.40
Gross cropped area	3.20	3.47	0.27 (7.78)
<b>Resource allocation</b>			
Machine power (hours)	26.10	26.10	0 (0.00)
Farm yard manure (tonnes)	20.00	20.00	0 (0.00)
Nitrogen (kg)	283.42	289.77	6.35 (2.24)
Phosphorus (kg)	136.31	129.66	-6.65 (-4.88)
Potash (kg)	66.19	58.66	-7.53 (-11.38)
Cash expenses on plant protection (₹)	1340	790.20	-513.80 (39.40)
Employment (Man days)	279.80	292.08	12.28 (4.39)
Water consumption (ha mm)	3316.56	3731.35	-185.21 (-22.27)
Working Capital (₹)	126587.70	124806.40	-1781.33 (-1.41)
Profit (₹)	45000.26	45865.04	864.77 (1.92)

*Figures in parentheses indicate percentage change in existing plan to optimum plan*

cropped area by 0.20 hectare (3.23 per cent). The existing area under banana was reduced by 0.20 ha. Two new crop enterprises such as brinjal and tomato had entered into the optimum sustainable plan with the area of 0.20 and 0.20 ha, respectively. The optimal large farm plan derived for head region envisaged a reduction in existing usage of machine power by 21.35 hours of machine power (14.87 per cent), farm yard manure by 10.66 tonnes (10.88 per cent), nitrogen by 134.67 kg (9.23 per cent), phosphorus by 8.73 kg (1.36 per cent), potash by 49.95 kg (13.22 per cent), Cash expenses on plant protection chemical by ₹525.07 (2.08 per cent), water by 257.07 ha mm (10.96 per cent). The optimal sustainable plan increased the profit by ₹7048.79 (3.68 per cent) over the existing plan and a significant decrease in working capital by ₹107394 (15.16 per cent). The optimum plan derived for large

**Table 5: Optimum sustainable crop production plans for large farms in head region**

Activities/Resources	Existing plan	Optimum plan	Percentage change in area and resource allocation*
<b>Area under crops (ha)</b>			
Paddy	5.20	5.20	0.00
Banana	1.60	1.40	-0.20
Brinjal	0.00	0.20	0.20
Tomato	0.00	0.20	0.20
Gross cropped area	6.80	7.00	0.20 (3.23)
<b>Resource allocation</b>			
Machine power (hours)	143.60	122.25	-21.35 (-14.87)
Farm Yard Manure (tonnes)	97.90	87.24	-10.66 (-10.88)
Nitrogen (kg)	1458.92	1324.25	-134.67 (-9.23)
Phosphorus (kg)	639.29	630.56	-8.73 (-1.36)
Potash (kg)	377.76	327.81	-49.95 (-13.22)
Cash expenses on plant protection (₹)	25225.20	24700.13	-525.07 (-2.08)
Employment (Man days)	523.60	523.60	0.00 (0.00)
Water consumption (ha mm)	9748.22	9691.15	-257.07 (-10.96)
Working Capital (₹)	708549.20	601155	-107394 (-15.16)
Profit (₹)	191784.50	198833.30	7048.79 (3.68)

Figures in parentheses indicate percentage change in existing plan to optimum plan

farms in head region was economically efficient, ecologically sound but socially inequitable.

The optimum sustainable crop plan derived for large farms in mid region indicated a significant increase in the gross cropped area by 0.80 hectare (11.11 per cent) when compared to the existing plan. The existing area under paddy and banana was maintained in optimum plan, while the existing area of 0.40 ha under bhendi was removed. Tomato entered as a new crop enterprise with an area of 1.20 ha in the optimum sustainable plan. The optimal large farm plan derived for mid region envisaged a reduction in existing usage of nitrogen by 127.55 kg (11.10 per cent), phosphorus by 105.26 kg (17.84 per cent), potash by 2.15 kg (0.83 per cent), cash expenses on plant protection chemical by ₹756.69 (9.06 per cent), water consumption by 697.60 ha mm (32.18 per cent), while in the case of inputs such as farmyard manure and machine power, it maintained the input usage as in the

**Table 6: Optimum sustainable crop production plan for large farms in mid region**

Activities/Resources	Existing plan	Optimum plan	Percentage change in area and resource allocation*
<b>Area under crops (ha)</b>			
Paddy	4.00	4.00	0.00
Banana	2.00	2.00	0.00
Bhendi	0.40	0.00	-0.40
Tomato	0.00	1.20	1.20
Gross cropped area	6.40	7.20	0.80 (11.11)
<b>Resource allocation</b>			
Machine power (hours)	77.68	77.68	
Farm yard manure (tonnes)	79.50	79.50	
Nitrogen (kg)	1148.92	1021.37	-127.55 (-11.10)
Phosphorus (kg)	590.08	484.82	-105.26 (-17.84)
Potash (kg)	257.12	254.97	-2.15 (-0.83)
Cash expenses on plant protection (₹)	8352.80	7596.15	-756.69 (-9.06)
Employment (Man days)	812.00	842.58	30.58 (3.77)
Water consumption (in ha mm)	7696.00	6998.40	-697.60 (-32.18)
Working capital (₹)	329810.10	326074.00	-3736.09 (-1.13)
Profit (₹)	83093.12	85878.33	2785.21 (3.35)

Figures in parentheses indicate percentage change in existing plan to optimum plan

existing plan with neither a reduction nor addition, thus satisfying fully the ecological goals. The optimal sustainable plan increased the profit by ₹2785.21 (3.35 per cent) over the existing plan and decreased the working capital by ₹3736.09 (1.13 per cent). The optimum plan derived for large farms in mid region was economically efficient, socially equitable and ecologically sound.

### CONCLUSIONS

The present study revealed that the optimum sustainable plan derived for medium farms in the mid region of the river basin was not ecologically sound. Similarly the normative sustainable crop plan for large farm in head region was proved to be socially inequitable. The study also indicated that the proportion of livestock was found lesser in medium farms of river basin than in small and large farms, which may be one of the reasons acting against the ecological efficiency by hampering the conservation of organic carbon through

recycling. Increasing the live stock population and resorting to soil amendments especially in medium farms in Tamirabarani irrigation system would conserve organic carbon in medium farms, there by making it ecologically sound. Attempting diversification of farming with live stock enterprises at optimum scale in large farms may generate additional employment opportunities, which may not alone improve the profit, but also address the social inequity issue. The study indicated the possibility of practicing sustainable agriculture in other categories of farms of the head and mid regions in Tamirabarani river

basin of Tamil Nadu state, India.

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## Economic Analysis of Milk Production by Small and Medium Sized Dairy Farmers in Punjab<sup>#</sup>

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### ABSTRACT

Dairy sector in Punjab has emerged as most crucial auxiliary for diversification of agriculture. The small and medium dairy farmers are an indispensable part of the milk production system as they contribute more than 75 per cent of the total milk production and marketed milk. The present study unravels the cost and returns of small and medium sized dairy farmers in Punjab. The study was undertaken in the three agro-climatic zones of Punjab. A multistage sampling technique was used to select the sample population. The results of the study revealed that the cost of per litre milk production incurred by small and medium sized dairy farmers was found to be ₹ 28.77 per litre and ₹ 26.76 per litre respectively in winter and ₹ 33.02 per litre and ₹ 31.37 per litre in summer. It was further observed that small sized dairy farmers were bearing losses in both the seasons while the medium sized dairy farmers were having profits indicating dairy farming not a profitable venture on small category dairy farms and to make it profitable one, the number of milch animals should be 6 or more. The study suggested that there is a need to sustain small and medium dairy farmers by providing them higher prices of milk and cheaper inputs to increase their profit margin. The government may follow a conducive integrate policy for the growth and expansion of dairy business in Punjab.

### Keywords

Cost and returns, dairy sector, medium dairy farmers, Punjab, small dairy farmers

### JEL Codes

Q12, Q13, Q18

### INTRODUCTION

Livestock sector is an important sub sector of Indian agriculture and within the livestock sector, dairying contributes significantly to the livestock GDP. The total milk production has increased from 17 million tonnes in 1950-51 to 146.30 million tonnes in 2014-15 (Anonymous, 2016). The combined share of landless, marginal and small dairy households in country's milk production is 77.34 percent (Singh *et al.*, 2013). Dairying contributes about 85, 50 and 34 percent to the total family income in case of landless, marginal and smallholders respectively (Jha *et al.*, 2014). Currently, Punjab produces 10.35 million tonnes of milk per year (Anonymous 2015) out of which two-third is marketed and one-third is retained for home consumption. More than 75 per cent of milk production and marketed milk are contributed by the

households with 3 or more milch animals (Kumar *et al.*, 2011) which make small and medium farmers an indispensable part of the milk production system.

This study is an attempt to evaluate the costs and returns from milk production among small and medium size category dairy farmers. There have been many studies in past (Singh & Rai, 1998; Jaiswal & Singh, 2015) which examined the economic analysis of milk production in various parts of country. But there is no current study on small and medium size category farmers. The present study will also act as the source of information to future researchers and stakeholders in the dairy industry.

### METHODOLOGY

The study was conducted in three agro-climatic zones of Punjab state viz. sub mountainous zone, central zone

<sup>#</sup>This paper is drawn from the M.Sc. thesis of the first author submitted to the Department of Dairy Economics and Business Management, GADVASU, Ludhiana

and south-western zone in the year 2015. A multistage sampling technique was used to select the sample population. In first stage, the district having highest milk production from each zone was selected and further two blocks were selected randomly from each district based on different situations of marketing of milk. In next stage, two villages were selected randomly from each selected block. Overall twelve villages were selected from three districts for detailed study. A comprehensive list of all the households from all the twelve villages having at least two milch animals and who marketed the milk throughout the year was prepared to identify the size ranges of small, medium and large dairy farmers using the commulative cube root frequency method of stratification. Two farm size categories were identified, Small (2-5 milch animals) and Medium (6-11 milch animals).

Data were collected from the selected dairy farmers through the use of face to face personal interviews with the aid of specially designed and pre-tested questionnaire. The questionnaire consisted both open and closed ended questions.

The tabular analysis was used for interpretation and comparison of the costs of milk production and returns from sale of milk for different categories of households. The analysis was carried out on per farm basis. Per farm analysis included the in-milk animals, dry animals, young ones and draught animals. Other statistical tools such as simple averages, weighted average, percentages etc. were also used wherever required.

Fixed costs at the farmer level were incurred on buildings, equipments, purchase of animals, depreciation on animals, buildings and equipments which do not vary with the level of milk production. As the investment on fixed items such as building, equipments, animals, etc. provide returns over several years, only depreciation and interest on the amount incurred on these fixed items is included while calculating the component of fixed costs. The components of variable costs of dairy enterprise at farmer level were feed, and fodder, labour, veterinary expenses and miscellaneous expenses on dairy farm. The net income received from the sale of milk, dung and calves was calculated by subtracting the gross costs from gross income for the winter season and profit per litre of milk was calculated.

## RESULTS AND DISCUSSION

### Milk production, consumption and marketed surplus of milk

An attempt was made to study the production, consumption and disposal pattern of milk in small and medium sized dairy farms in Punjab State. It was revealed from the Table 1 that the average daily milk production per household in small size farm category was 15.56 litres in summer and 17.48 litres in winter season. The marketed surplus accounted for 62.73 per cent of total milk production in summer season and 70.14 per cent in winter season in the state. In medium size farm category, the average daily milk production per household was 30.29

litres in summer and 35.09 litres in winter season. The marketed surplus in case of medium size farm category accounted for 77.22 per cent of total milk production in summer season and 80.02 per cent in winter season in the state. The marketed surplus was higher in winter season as compared to summer season due to the decreased milk production in summer season as compared to winter. Another reason for reduced marketed surplus in summer season was increase in quantity of milk retained at home. In category wise analysis, the proportion of marketed surplus of milk was observed higher in medium sized category as the quantity of total milk produced was very high as compared to small sized category farmers.

### Costs and returns from dairying

Profitability of dairy farming depends upon the milk yield, price of milk and cost of milk production. Therefore, it is essential to know the cost of milk production in rural areas to have a glimpse of the profitability of the dairy farming. The major proportion of the cost is constituted by the variable cost and rest by the fixed cost. By studying various components of variable and fixed costs, one can be able to judge which component can be reduced with the aim of cutting down the cost of milk production and hence increasing the profitability.

### Fixed costs of milk production

A **fixed cost** is a **cost** that does not change with an increase or decrease in the amount of goods or services produced. The fixed cost of milk production on per farm basis among different farm size categories in three zones of Punjab have been presented in Table 2. A perusal of the table revealed that the total fixed cost per day per farm for small size category farmers during the year was found to be highest in Central zone i.e. ₹ 65.31 followed by Sub Mountainous Zone (₹ 59.46) and South Western Zone (₹ 56.32) respectively with an overall figure of ₹ 60.36 in Punjab. The total fixed cost per day per farm for medium size category farmers followed the same trend i.e. highest in Central zone (₹ 110.29) followed by Sub Mountainous Zone (₹ 99.79) and South Western Zone (₹ 85.14) respectively with an overall figure of ₹ 98.40 in Punjab. In a category-wise analysis, the total fixed investments increased with the increase in herd size indicating the heavy investments on medium sized dairy farms. The high fixed cost per day per farm in Central zone was on account of higher interest on animals and depreciation and interest on buildings particularly among medium size category dairy farmers. Overall, out of total fixed investments of medium size category farms of ₹ 98.40/day/farm the maximum investment was on interest on buildings (₹ 34.76) followed by interest on animals (₹ 22.97) which indicates heavy investments on sheds and animals on medium size farm category.

### Variable costs of milk production

**Variable costs** are those **costs** that vary depending on production volume; they rise as production increases and fall as production decreases. Variable costs include

components like green fodder, dry fodder, concentrates, labour and other expenses. The variable costs of milk production vary zone wise, category wise and season wise. The variable cost of milk production on per farm

basis among different farm size categories in various zones of Punjab in winter and summer season have been presented in Table 3.

A perusal of the table revealed that the total variable

**Table 1: Zone wise average production, consumption and marketed surplus of milk in Punjab, 2015-16**

Category	Average milk yield per milch animal (lts/day/farm)	Summer				Winter			
		Average per farm (lts/day/farm)				Average per farm (lts/day/farm)			
		Milk production	Home consumption	Suckled by calves	Marketed surplus	Milk production	Home consumption	Suckled by calves	Marketed surplus
<b>Central</b>									
Small	5.48	16.24 (100.00)	4.63 (30.38)	0.94 (6.16)	10.67 (63.46)	18.54 (100.00)	4.54 (24.48)	1.09 (5.88)	12.91 (69.64)
Medium	6.36	32.45 (100.00)	5.03 (15.74)	1.63 (5.10)	25.79 (79.15)	37.45 (100.00)	4.92 (13.14)	1.83 (4.89)	30.70 (81.97)
<b>South Western</b>									
Small	4.54	15.35 (100.00)	4.93 (34.35)	0.70 (4.88)	9.72 (60.78)	17.19 (100.00)	4.17 (24.26)	0.93 (5.41)	12.09 (70.33)
Medium	4.80	28.34 (100.00)	5.65 (19.94)	1.62 (5.72)	21.07 (74.82)	32.56 (100.00)	5.53 (16.98)	2.08 (6.39)	24.95 (76.63)
<b>Sub Mountainous</b>									
Small	4.84	15.08 (100.00)	4.40 (31.25)	0.62 (4.40)	10.06 (64.35)	16.72 (100.00)	4.05 (24.22)	0.88 (5.26)	11.79 (70.51)
Medium	5.07	30.57 (100.00)	5.41 (17.70)	1.36 (4.45)	23.80 (77.85)	35.26 (100.00)	4.69 (13.30)	1.98 (5.62)	28.59 (81.08)
<b>Punjab</b>									
Small	4.95	15.56 (100.00)	4.65 (32.09)	0.75 (5.18)	9.09 (62.73)	17.48 (100.00)	4.25 (24.31)	0.97 (5.55)	12.26 (70.14)
Medium	5.41	30.29 (100.00)	5.36 (17.69)	1.54 (5.08)	23.39 (77.22)	35.09 (100.00)	5.05 (14.39)	1.96 (5.59)	28.08 (80.02)

Figures in parentheses indicate the percentage

**Table 2: Zone wise fixed cost of milk production in Punjab, 2015-16**

Particulars/ Category	(₹ per day per farm)							
	Animals		Buildings		Equipments		Land rent	Total fixed investment
	Depreciation	Interest	Depreciation	Interest	Depreciation	Interest	Interest	
(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(i to vii)	
<b>Central</b>								
Small	8.01	18.63	7.32	18.31	6.27	6.59	0.18	65.31
Medium	12.38	24.71	15.23	38.07	9.54	10.02	0.34	110.29
<b>South Western</b>								
Small	8.32	17.64	6.16	12.94	5.35	5.61	0.30	56.32
Medium	9.29	20.37	10.33	30.80	6.27	6.58	0.50	85.14
<b>Sub Mountainous</b>								
Small	8.70	16.80	6.26	15.64	5.81	6.10	0.15	59.46
Medium	12.65	23.84	13.70	35.42	6.77	7.11	0.30	99.79
<b>Punjab</b>								
Small	8.34	17.69	6.58	18.35	5.81	6.10	0.21	60.36
Medium	11.44	22.97	13.08	34.76	7.52	7.90	0.38	98.40

Table 3: Zone wise variable cost for milk production in Punjab, 2015-16

Particulars/	₹ Per day per farm)													
	Winter						Summer							
	Green fodder	Dry fodder	Concentrates	Labour charges	Vety. Expenses	Misc. expenses	Total variable cost	Green fodder	Dry fodder	Concentrates	Labour charges	Vety. Expenses	Misc. expenses	Total variable cost
(i)	(ii)	(iii)	(iv)	(v)	(vi)	(i to vi)	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(i to vi)	
<b>Central</b>														
Small	120.51	66.77	135.72	145.07	2.54	7.59	478.20	138.71	55.77	122.61	152.84	3.54	8.59	482.06
Medium	296.43	133.53	231.32	238.34	11.13	20.45	931.20	325.56	115.43	221.29	247.58	12.63	23.85	946.34
<b>South Western</b>														
Small	112.76	56.89	125.84	119.45	4.94	4.07	423.95	120.35	48.89	116.54	138.28	5.84	6.07	435.97
Medium	262.63	111.58	170.71	175.51	10.1	13.71	744.24	305.58	103.45	150.81	179.06	11.6	16.71	767.21
<b>Sub Mountainous</b>														
Small	108.45	62.46	122.77	125.25	2.24	5.31	426.48	123.91	52.46	118.84	142.61	3.14	7.31	448.27
Medium	278.52	128.63	206.67	210.79	9.49	17.85	851.95	315.53	118.93	191.66	204.47	11.09	20.66	862.34
<b>Punjab</b>														
Small	113.91	62.04	128.11	129.92	3.24	5.66	442.88	127.66	52.37	119.33	144.58	4.17	7.32	455.43
Medium	279.19	124.58	202.90	208.21	10.24	17.34	842.46	315.56	112.60	187.92	210.37	11.77	20.41	858.63

cost per day per farm for small size farm category in winter season was found to be highest in Central Zone i.e. ₹ 478.20 followed by ₹ 426.48 and ₹ 423.95 in Sub Mountainous Zone and South Western Zone respectively with an overall figure of ₹ 442.88 in Punjab. In summer season the total variable cost per day per farm for small size farm category in summer season was again found to be highest in Central Zone i.e. ₹ 482.06 followed by ₹ 448.27 and ₹ 435.97 in Sub Mountainous Zone and South Western Zone respectively with an overall figure of ₹ 455.43 in Punjab. The same zone wise pattern was followed in medium size farm category. The total variable cost per day per farm for medium size farm category in winter season was found to be highest in Central Zone i.e. ₹ 931.20 followed by ₹ 851.95 and ₹ 744.24 in Sub Mountainous Zone and South Western Zone respectively with an overall figure of ₹ 842.46 in Punjab. The total variable cost per day per farm for medium size farm category in summer season was found to be highest in Central Zone i.e. ₹ 946.34 followed by ₹ 862.34 and ₹ 767.21 in Sub Mountainous Zone and South Western Zone respectively with an overall figure of ₹ 858.63 in Punjab. Out of the total variable costs the highest contributors were found to be green fodder, labour, concentrates and dry fodder. The zone wise difference in variable costs was due to the difference in prices of green and dry fodder and the different quantities of green and dry fodder being fed to the animals among three zones. In a category-wise analysis, the total variable cost per farm increased with the increase in herd size which was due to the fact that medium size farm category farmers use higher quantities of concentrates at their farms as compared to small category farmers. The season wise difference in the variable cost of milk production was due to the increased costs of green fodder and labour resulting from higher wage rates in summer season.

#### **Total cost of milk production**

Total cost refers to the total expenses incurred on milk production. Total cost is the sum of both fixed and variable costs of milk production. The total cost of milk production on per farm basis among different farm size categories in various zones of Punjab for winter season has been presented in Table 4. It is clear from the table that the total cost per day per farm among small size category farmers in winter was found to be the highest in Central Zone with ₹ 543.51 followed by Sub Mountainous Zone (₹ 485.94) and South Western Zone (₹ 480.27) with an overall figure of ₹ 503.24 in Punjab. Further, cost of milk production on per litre basis among small size category farmers was highest in Central Zone i.e. ₹ 29.32per litre followed by Sub Mountainous Zone with ₹ 29.06per litre and South Western Zone with ₹ 27.94per litre with an overall figure of ₹ 28.77per litre in Punjab. The labour component of variable cost can be divided into two components hired labour and family labour. In small sized category major component of labour cost was found to be

the family labour i.e. about 79 per cent of total labour cost so after excluding the family labour cost the cost of milk production on per litre basis reduces to ₹ 23.49per litre in Central zone, ₹ 22.67per litre in South Western zone and ₹ 22.94per litre in Sub Mountainous zone with an overall value of ₹ 23.05 in Punjab.

The total cost per day per farm among small size category farmers in summer was found to be the highest in Central Zone with ₹ 547.37 followed by Sub Mountainous Zone (₹ 507.73) and South Western Zone (₹ 492.29) with an overall figure of ₹ 515.80 in Punjab. Further, cost of milk production on per litre basis among small size category farmers was highest in Central Zone i.e. ₹ 33.71per litre followed by Sub Mountainous Zone with ₹ 33.67per litre and South Western Zone with ₹ 31.68per litre with an overall figure of ₹ 33.02per litre in Punjab. The cost of milk production on per litre basis after excluding the family labour cost reduced to ₹ 27.06per litre in Central zone, ₹ 26.17per litre in South Western zone and ₹ 26.88per litre in Sub Mountainous zone with an overall value of ₹ 26.71per litre in Punjab.

The total cost per day per farm among medium size category farmers in winter was found to be the highest in Central Zone with ₹ 1041.49 followed by Sub Mountainous Zone (₹ 951.74) and South Western Zone (₹ 829.38) with an overall figure of ₹ 940.87 in Punjab. Further, cost of milk production on per litre basis among medium farmers was highest in Central Zone i.e. ₹ 27.81per litre followed by Sub Mountainous Zone with ₹ 26.99per litre and South Western Zone with ₹ 25.47per litre with an overall figure of ₹ 26.76per litre in Punjab.

The cost of milk production on per litre basis after excluding the family labour cost reduced to ₹ 22.93per litre in Central zone, ₹ 21.77per litre in South Western zone and ₹ 22.35per litre in Sub Mountainous zone with an overall value of ₹ 22.38per litre in Punjab. The total cost per day per farm among medium size category farmers in summer was found to be the highest in Central Zone with ₹ 1056.63 followed by Sub Mountainous Zone (₹ 962.13) and South Western Zone (₹ 852.35) with an overall figure of ₹ 957.04 in Punjab. Further, cost of milk production on per litre basis among medium size category farmers was highest in Central Zone i.e. ₹ 32.56per litre followed by Sub Mountainous Zone with ₹ 31.47per litre and South Western Zone with ₹ 30.08per litre with an overall figure of ₹ 31.37per litre in Punjab. After excluding the labour cost the cost of milk production on per litre basis after excluding the family labour cost reduced to ₹ 26.93per litre in Central zone, ₹ 25.82per litre in South Western zone and ₹ 26.12per litre in Sub Mountainous zone with an overall value of ₹ 26.32per litre in Punjab.

In a category wise analysis, the cost of milk production on per litre basis decreased with increase in herd size in both summer and winter seasons indicating the

Table 4: Zone wise total cost for milk production in Punjab, 2015-16:

Particulars / Category	Winter						Summer					
	Fixed cost (i)	Variable cost (ii)	Total cost (i+ii)	Total cost excluding family labour	Daily milk production (lt)	Cost of milk production (per lt) excluding family labour (per lt)	Fixed cost (i)	Variable cost (ii)	Total cost (i+ii)	Total cost excluding family labour	Daily milk production (lt)	Cost of milk production (per lt) excluding family labour (per lt)
<b>Central</b>												
Small	65.31	478.20	543.51	435.52	18.54	29.32	23.49	482.06	547.3	439.38	16.24	33.71
Medium	110.2	931.20	1041.4	858.71	37.45	27.81	22.93	946.34	1056.	873.85	32.45	32.56
<b>South Western</b>												
Small	56.32	423.95	480.27	389.66	17.19	27.94	22.67	435.97	492.2	401.68	15.35	31.68
Medium	85.14	744.24	829.38	708.77	32.56	25.47	21.77	767.21	852.3	731.74	28.34	30.08
<b>Sub Mountainous</b>												
Small	59.46	426.48	485.94	383.61	16.72	29.06	22.94	448.27	507.7	405.40	15.08	33.67
Medium	99.79	851.95	951.74	788.17	35.26	26.99	22.35	862.34	962.1	798.56	30.57	31.47
<b>Punjab</b>												
Small	60.36	442.88	503.24	402.93	17.48	28.77	23.05	455.43	515.8	415.49	15.56	33.02
Medium	98.40	842.46	940.87	785.22	35.09	26.76	22.38	858.63	957.0	801.38	30.45	31.37

prevalence of economies of scale on medium sized farms. In a zone wise analysis, the total cost of milk production per day per farm was observed to be highest in Central zone on account of high fixed and variable costs of milk production. The fixed costs were high due to the large investments on sheds and animals in Central zone and the variable costs were high due to the use of larger quantities of green fodder and concentrates in Central zone as compared to other two zones. In a season wise analysis, the per litre cost of milk production was found to be higher in summer season which was mainly due to lower milk yield and increased variable costs in summer season.

#### **Dairy enterprise profit from milk production in winter**

Dairy enterprise profits from milk production refer to the net profit earned by farmers by selling one litre of milk produced. Basically, it is calculated by subtracting the total cost of milk production from the net returns received by the farmers. Net returns include the income received from milk, manure and young ones sold by the farmers. Dairy enterprise profits from milk production on per farm basis among different farm size categories in various zones of Punjab for winter season have been presented in Table 5.

A perusal of the table showed that net returns of the small size category farmers were found to be highest in Central zone with ₹ 577.10 followed by Sub Mountainous zone (₹ 467.14) and South Western zone (₹ 448.53) with an overall value of ₹ 501.05 per day per farm in Punjab. Out of total returns the major share was from sale of milk (about 97 per cent) in the state. Dairy enterprise profit from milk production per day per farm on per litre basis was calculated by subtracting the total costs of milk production from the net returns received by the dairy farmers. The dairy enterprise profit for small category in winter was found to be the highest in Central zone i.e. ₹ 1.81 per litre. In other two zones the farmers were bearing losses. There was a loss of ₹ 1.85 per litre and ₹ 1.12 per litre in South Western and Sub Mountainous zones respectively with an overall value of ₹ 0.39 per litre in Punjab. It is worth mentioning here that if the family labour charges are excluded from total costs then the small farmers earn profits among all the zones. The dairy enterprise profit after excluding the family labour charges was found to be highest in Central zone i.e. ₹ 7.64 per litre followed by Sub Mountainous zone (₹ 5.00 per litre) and South Western zone (₹ 3.42 per litre) with an overall value of ₹ 5.41 per litre in Punjab. The small size category farmers were incurring higher costs of milk production because of lesser milk yield, moreover the price received of milk sold was also less thus, the small size category farmers were bearing losses in the state.

The net returns for medium sized category followed the same trend i.e. highest in Central zone with ₹ 1246.88 followed by Sub Mountainous zone (₹ 1075.57) and South Western zone (₹ 949.57) with an overall value of ₹

1090.67 in Punjab. The dairy enterprise profit from milk production per day per farm on per litre basis for medium category in winter was found to be the highest in Central Zone i.e. ₹ 5.48 per litre followed by ₹ 3.69 per litre and ₹ 3.51 per litre in South Western and Sub mountainous Zone respectively with an overall figure of ₹ 4.23 per litre in Punjab. The price received of milk sold by medium size category farmers was higher and the cost of milk production was less due to higher milk yield thus, the medium size category farmers were earning profits in the state.

#### **Dairy enterprise profit from milk production in summer**

Dairy enterprise profits from milk production on per farm basis among different farm size categories in various zones of Punjab for summer season have been presented in Table 6. A perusal of the table showed net returns of the small dairy farmers were found to be highest in Central zone with ₹ 540.67 followed by Sub Mountainous zone (₹ 464.44) and South Western zone (₹ 423.99) with an overall value of ₹ 476.37 per day per farm in Punjab. The maximum proportion in net returns was observed to be from sale of milk. The small size dairy farmers were found to be bearing losses across all the three zones. It was found to be lowest in Central Zone i.e. ₹ -0.41 per litre followed by Sub Mountainous zone ₹ -2.87 per litre and South Western zone ₹ -4.45/ with an overall value of ₹ -2.58 per litre in Punjab. The negative value of dairy enterprise profit was on account of lesser milk yield and higher per litre cost of milk production. If the family labour charges are excluded from total costs then the small size category farmers earn profits among all the zones. The dairy enterprise profit after excluding the family labour charges was found to be highest in Central zone i.e. ₹ 6.24 per litre followed by Sub Mountainous zone (₹ 3.92 per litre) and South Western zone (₹ 1.45 per litre) with an overall value of ₹ 3.91 per litre in Punjab.

The net returns for medium size farm category followed the same trend i.e. highest in Central zone with ₹ 1145.49 followed by Sub Mountainous zone (₹ 981.35) and South Western zone (₹ 876.28) with an overall value of ₹ 1001.04 in Punjab. The dairy enterprise profit from milk production per day per farm on per litre basis for medium size farm category in summer was found to be the highest in Central Zone i.e. ₹ 2.74 per litre followed by South Western Zone (₹ 0.84 per litre) and Sub Mountainous zone (₹ 0.64 per litre) with an overall figure of ₹ 1.40 per litre in Punjab. In a category wise analysis, dairy enterprise profit per day per farm on per litre basis increased with increase in herd size. As the cost of milk production on per litre basis decreases with increase in herd size and price of milk receive by medium farmers was higher as compared to small size category farmers, the total profit earned by medium size category farmers was high as compared to small farmers. This indicates that dairy farming was not a profitable venture on small

Table 5: Zone wise profit from milk production during winter in Punjab, 2015-16

Particulars/ Category	Milk production (Its)	Price / litre	Returns from			Total returns ( i to iii)	Including Family Labour			Dairy enterp. profit / litre excluding family labour									
			Milk sale		Young ones (iii)		Total cost	Cost / litre	Dairy enterp. profit		Dairy enterp. profit / litre								
			(i)	(ii)								(iii)	(iv)	(v)	(vi = iii+iv+v)	(vii)	(viii = vii/i)	(ix = vi-vii)	(x = ix/i)
<b>Central</b>																			
Small	18.54	30.16	559.17	10.63	7.30	577.10	543.51	29.32	33.59	1.81	7.64								
Medium	37.45	32.54	1218.62	15.11	13.15	1246.88	1041.49	27.81	205.39	5.48	10.37								
<b>South Western</b>																			
Small	17.19	25.66	441.10	4.40	3.03	448.53	480.27	27.94	-31.74	-1.85	3.42								
Medium	32.56	28.48	927.31	11.62	10.64	949.57	829.38	25.47	120.19	3.69	7.40								
<b>Sub Mountainous</b>																			
Small	16.72	27.36	457.46	7.58	2.10	467.14	485.94	29.06	-18.80	-1.12	5.00								
Medium	35.26	30.02	1058.51	10.24	6.82	1075.57	951.74	26.99	123.83	3.51	8.15								
<b>Punjab</b>																			
Small	17.48	28.17	489.37	7.54	4.14	501.05	503.24	28.77	-5.65	-0.39	5.41								
Medium	35.09	30.35	1068.15	12.32	10.20	1090.67	940.87	26.76	149.80	4.23	8.70								

Table 6: Zone wise profit from milk production during summer in Punjab, 2015-16

Particulars/ Category	Milk production (lts)	Price / litre	Returns from			Total returns ( i to iii)	Including Family Labour			Dairy enterp. profit / litre excluding family labour	
			Milk sale (i)	Manure (ii)	Young ones (iii)		Total cost	Cost / litre	Dairy enterp. profit		Dairy enterp. profit / litre
<b>Central</b>											
Small	16.24	32.25	523.74	10.63	6.3	540.67	547.37	33.71	-6.70	-0.41	6.24
Medium	32.45	34.46	1118.23	15.11	12.15	1145.49	1056.63	32.56	88.86	2.74	8.37
<b>South Western</b>											
Small	15.35	27.17	417.06	4.4	2.53	423.99	492.29	32.07	-68.30	-4.45	1.45
Medium	28.34	30.17	855.02	11.62	9.64	876.28	852.35	30.08	23.93	0.84	5.10
<b>Sub Mountainous</b>											
Small	15.08	30.16	454.81	7.58	2.05	464.44	507.73	33.67	-43.29	-2.87	3.92
Medium	30.57	31.56	964.79	10.24	6.32	981.35	962.13	31.47	19.22	0.63	5.98
<b>Punjab</b>											
Small	15.56	29.86	465.20	7.54	3.63	476.37	515.80	33.15	-39.43	-2.58	3.91
Medium	30.45	32.06	979.34	12.32	9.37	1001.04	957.04	31.37	44.00	1.40	6.56

category dairy farms and to make it profitable one, the number of milch animals should be 6 or more. It was observed that the profits earned by both small and medium size category farmers were less in summer season as compared to winter season.

This season wise difference in dairy enterprise profit in both categories was due to increased variable cost of milk production and decreased milk yield per milch animal in summer season. Though the price received by farmers in summer season was higher than winter still the profit earned in summer was less due to increased cost and decreased milk yield. Thus, it can be concluded that the positive impact of increased price was nullified by the higher cost and lower milk yield in summer season.

### CONCLUSIONS

The results of the study revealed that there is a gap between existing milk yield in Punjab State and milk yield of small and medium farmers. Therefore, there is a need to bridge those gaps by improving quality of animals to increase the profits of small and medium size farmers for which genetic improvement of cattle by encouraging the farmers to up-grade the local breeds to crossbred animals enhance the productivity and production which will further increase the profit of dairy farmers. Further, it was observed that there is a need to reduce the cost of milk production of small and medium size category farmers. Efficiency and management is also a major issue among small and medium size category of farmers. The major proportion of total costs belongs to variable costs in both small and medium category farmers. So, variability in the market price of these inputs can deviate the total variable cost of milk hence, increasing the total cost of milk

production. There exist an inconsistency and non-uniformity in pricing of milk. It is suggested that this problem of farmers can be addressed only by organized sector. Hence, organized sector should be promoted so that higher and uniform price of milk should be paid to the producers of milk. The government may follow a conducive integrate policy for the improvement of dairy enterprise by providing infrastructural facility for strengthening marketing of milk.

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## Bio-intensive Complementary Cropping Systems to Revitalize Sustainability and Profitability in Punjab Agriculture<sup>#</sup>

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### ABSTRACT

This study aims to evaluate the effect of twelve crop sequences on productivity, profitability and water use efficiency. The results elucidated maximum rice equivalent yield for the cropping system of maize (furrow) + turmeric (bed) – wheat (bed) + linseed (furrow) (282.6 q/ha) which was followed by maize (furrow) + turmeric (bed) - barley (bed) + linseed (furrow) (264.4 q/ha), and basmati rice-radish- spring maize (237.4 q/ha) cropping systems. These cropping systems produced an additional rice equivalent yield of 107 to 152 q/ha and saved 10 to 165 cm irrigation water over the rice-wheat system. Maize (furrow) + turmeric (bed) - wheat (bed) + linseed (furrow) gave highest production efficiency (77.41 kg/day/ha), net returns (₹2,89,483/ha) and proved to be a viable option to avail higher profitability for farmers in Punjab.

### Keywords

Cropping systems, productivity, profitability, water use efficiency

### JEL Codes

C81, Q01, Q16, Q18

### INTRODUCTION

Rice-wheat cropping system gave birth to many problems related to low water use efficiency, land degradation problems, indiscriminate exploitation of groundwater, in-efficient land use, decline in factor productivity, imbalance in fertilizer use, build up of diseases, pests and concerns of environmental quality. Diversification and intensification of rice-wheat based system to increase productivity per unit resource is very pertinent. Crop diversification shows lot of promises like, fulfilling basic needs for cereals, pulses, oilseeds and vegetables and, regulating farm income, withstanding weather aberrations, ensuring balanced food supply, conserving natural resources, reducing the chemical fertilizer and pesticide loads, ensuring environmental safety and creating employment opportunity (Gill & Ahlawat, 2006). Crop diversification has been recognized as an effective strategy for achieving the objectives of food security, nutrition security, income growth, poverty alleviation, employment generation, judicious use of land

and water resources, sustainable agricultural development and environmental improvement (Hedge *et al.*, 2003). In the era of shrinking resource base of land, water and energy, resource use efficiency is an important aspect for considering the suitability of a cropping system (Yadav, 2002). Hence, selection of component crops needs to be suitably planned to harvest the synergism among them towards efficient utilization of resource base and to increase overall productivity (Anderson, 2005). Therefore the present experiment was carried out to evaluate the most suitable cropping system with respect to high productivity levels and rational use of resources and to test the feasibility and economics of different cropping systems.

### MATERIAL AND METHODS

The study was conducted at Punjab Agricultural University, Ludhiana centre of All India Coordinated Research Project on Integrated Farming System during 2011-12 to 2012-13. The soil of experimental field was sandy loam in texture. Twelve cropping systems were

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evaluated for their production potential and economics, viz.,

S<sub>1</sub>: Rice-Wheat; S<sub>2</sub>: Basmati rice-Hayola-Summer moongbean; S<sub>3</sub>: Basmati rice-Radish- Spring maize; S<sub>4</sub>: Maize-Potato-Spring maize; S<sub>5</sub>: Maize(furrow) + Turmeric (bed)-Barley (bed) + Linseed (furrow); S<sub>6</sub>: Maize (furrow) + Turmeric(bed)-Wheat (bed) + Linseed(furrow); S<sub>7</sub>: Maize(furrow) + Radish (bed) - Wheat (Bed) + Linseed(Furrow)-Summer moongbean; S<sub>8</sub>: Groundnut+ Arhar-Wheat+ Gobhisarson; S<sub>9</sub>: Cotton + Dhaincha-Radish(bed) + Hayola transplanted (furrows); S<sub>10</sub>: Cotton + Dhaincha-Wheat+Linseed (furrows); S<sub>11</sub>: Maize (cobs) + Vegetable Cowpea + Sesbania - Mustard + Gram - Green gram; S<sub>12</sub>: Sorghum+ Cowpeas (fodder)- Wheat+ Mustard (9:1) – cowpeas(Vegetable)+ fodder.

A randomized block design was followed with four replications. For comparison between crop sequences, the yields of all the crops were converted into rice equivalent yield on price basis. The mean of prevailing market rates during 2011-12 and 2012-13 were used for computing economic viability. The water use productivity of different cropping systems was calculated by dividing the rice grain-equivalent yield of the system by the total of average water use by different crops in the cropping system.

## RESULTS AND DISCUSSION

### Crop Productivity

The results revealed that there is sufficient scope to replace rice-wheat system with other systems without any decline in economic yield rather it improved substantially (Table 1 and 2). The maize (furrow) + turmeric (bed) –wheat + linseed (furrow), maize (furrow) + turmeric (bed) - barley (bed) + linseed (furrow), basmati rice-radish-spring maize, maize- potato- spring maize, basmati rice-hayola (transplanted)-summer moongbean (G+R), maize (furrow) + radish(bed) - wheat+ linseed (furrow)-summer moongbean, gave rice equivalent yield as 282.6, 264.4, 237.4, 185.2, 183.7 and 165.0 q/ha/annum as against 130.2 q/ha/annum in rice-wheat system which clearly elucidated the superiority of these systems over rice-wheat system. These systems also help to save substantial quantity of irrigation water. It is therefore, pertinent that shifting of small area under the systems discussed above related to crop diversification and intensification concept can help to conserve the resources and keep productivity level intact. In Trans-Gangetic plains, the system productivity of maize based cropping systems viz., 'maize-wheat-green gram', 'maize-potato-green gram' and 'maize-potato-onion' was remarkably higher over rice-wheat system. Further, the irrigation water productivity in maize based systems was more than double compared to rice-wheat system (Gill & Sharma, 2005). Singh (2006) reported that in peri-urban interface, high value cropping systems involving maize are more remunerative than the 'rice-wheat' cropping system. According to other carried out studies, maize-potato-onion; summer groundnut-potato-pearlmillet (f) and

maize-potato-summer moong bean produced significantly higher rice equivalent yield as 22.5, 15.8 and 15.8 t/ha per annum in rice-wheat system which clearly remarked the superiority of these systems over rice-wheat system (Walia et al., 2010). Choudhary et al. (2001) also reported greater productivity by replacing wheat in rice-wheat system with vegetables crops like radish and potato. Sharma et al.(2004) have also reported that intensification through inclusion of vegetables and leguminous crops increase the production and land use efficiency.

### Production efficiency and water saving

The cropping systems having 300 per cent cropping intensity viz., maize (furrow) + turmeric (bed) -wheat (bed) + linseed (furrow) used 165 cm less water than rice-wheat (Table 2). The second best cropping system proved as maize (furrow) + turmeric (bed) - barley (bed) + linseed (furrow) showed a great performance and saved 172 cm of irrigation water. The maize-potato-spring maize cropping system showed production efficiency of 72.43 kg/ day/ ha and resulted in saving of 116 cm irrigation water. In basmati rice-hayola (transplanted)-summer moongbean cropping system in which the residues of summer moongbean were buried in the field, total irrigation water used as 221.5 cm; there by indicating the net saving of irrigation water to the extent of 34 cm. The maize (furrow) + radish (bed) - wheat (bed) + linseed (furrow)-summer moongbean another promising cropping system, gave 45.21 kg/ day/ ha of production efficiency with 116.5 cm of irrigation water leading to 139 cm saving of water. Water is the most crucial input and must be used rationally and these results consolidate the scope for immediate shift to the high productivity cropping systems as stated above. Similarly, according to Sharma et al., 2004, maize-potato-onion system gave the highest productivity (278.6 q/ha/annum) and used 82 cm less water than rice-wheat system with a productivity margin of 132.4 q/ha/annum. The summer groundnut-potato-bajra (fodder) system gave 233.0 q/ha/annum productivity with 103 cm irrigation water leading to 109 cm saving of water. Maize-potato-summer moong cropping system gave 191.0 q/ha/annum productivity with total irrigation water used as 92 cm, thereby indicating the net saving of irrigation water to the extent of 120 cm. The maize-wheat-summer moong produced 161.8 q/ha/annum productivity and used only 68 cm irrigation water which was 68 per cent less than irrigation water used for rice-wheat system. There is need to adopt water saving crops in many areas, excessive exploitation has pushed the groundwater table below the critical depth of 10 meters (Dhawan & Singh, 2015).

### Irrigation water application efficiency

The maize (furrow) + turmeric (bed) - barley (bed) + linseed (furrow) and maize (furrow) + turmeric (bed) – wheat (bed) + linseed (furrow) cropping systems showed highest water use efficiency (3.185 and 3.140 kg grain/m<sup>3</sup> irrigation water) followed by and cotton+ sesbania- radish (bed)+ hayola transplanted (furrows) (1.818 kg grain/m<sup>3</sup>

Table 1: Economic yield of grain of different cropping systems in 2011-12 and 2012-13

Cropping systems	Grain						Straw					
	Kharif		Rabi		Summer		Kharif		Rabi		Summer	
	Main	Inter-crop	Main	Inter-crop	Main	Inter-crop	Main	Inter-crop	Main	Inter-crop	Main	Inter-crop
Rice-wheat	63.6	-	54.5	-	-	-	106.3	-	107.5	-	-	-
Basmati rice- Hayola (transplanted) – Summer moongbean (G+R)	40.3	-	18.3	-	11.5	96.8	-	111.2	-	68.4	-	-
Basmati rice- Radish- Spring maize	40.0	-	187.5	-	64.7	96.7	-	-	-	153.2	-	-
Maize- Potato- Spring maize	51.1	-	216.0	-	64.1	112.6	-	58.3	-	157.6	-	-
Maize (furrow) + Turmeric (bed) - Barley (bed) + Linseed (furrow)	40.7	196.7	36.9	3.5	-	101.8	113.0	65.8	17.8	-	-	-
Maize (furrow) + Turmeric (bed) - Wheat (Bed) + Linseed (furrow)	42.4	204.2	40.2	3.9	-	103.9	116.5	65.2	20.3	-	-	-
Maize (furrow)+Radish (bed)-Wheat (bed)+Linseed (furrow)-Summer moongbean	42.5	86.0	38.5	4.1	11.1	108.5	22.9	66.0	21.8	68.9	-	-
Groundnut + Arhar (5:1) – Wheat + Sarson (9:1)	19.9	5.5	48.3	2.7	-	106.9	38.5	89.8	13.7	-	-	-
Cotton + Sesbainia –Radish (bed) + Hayola transplanted (furrows)	13.6	-	134.8	15.4	--	73.6	-	91.8	-	-	-	-
Cotton + Sesbainia –Wheat (bed) + Linseed (furrows)	14.8	-	37.7	3.9	-	55.2	-	71.3	19.1	-	-	-
Maize (cobs) + Vegetable Cowpea + sesbania - Mustard +Gram -Green gram	215.8	33.7	3.1	16.6	11.0	110.5	76.1	50.9	-	65.3	-	-
Sorghum+Cowpeas (fodder)- Wheat+Mustard (9:1)-Cowpeas (Vegetable)+Fodder	293.5		48.8	2.5	47.7	789.4		89.8	12.9	184.6		

**Table 2: Economic analysis of different cropping systems**

Cropping systems	Rice equivalent yield (q/ha)	Production efficiency (kg/day/ha)	Irrigation water (cm)	Irrigation water use efficiency (kg grain/m <sup>3</sup> irrigation water)	Gross returns (₹/ha)	Input cost (₹/ha)	Net return (₹/ha)
Rice-wheat	130.2	35.66	255.5	0.509	166613	57100	109513
Basmati rice- Hayola (transplanted) – Summer moongbean (G+R)	183.7	50.32	221.5	0.829	235079	64533	170546
Basmati rice- Radish- Spring maize	237.4	65.05	248	0.957	303933	72406	231527
Maize- Potato- Spring maize	185.2	50.75	139	1.333	237108	86949	150159
Maize (furrow) + Turmeric (bed) - Barley (bed) + Linseed (furrow)	264.4	72.43	83	3.185	338375	72198	266177
Maize (furrow) + Turmeric (bed) - Wheat (Bed) + Linseed (furrow)	282.6	77.41	90	3.140	361681	72198	289483
Maize (furrow) + Radish (bed) - Wheat (bed) + Linseed (furrow) – Summer moongbean	165.0	45.21	116.5	1.416	211198.5	78320	132878.5
Groundnut + Arhar (5:1) – Wheat + Sarson (9:1)	106.1	29.07	75	1.415	135822	48675	87147
Cotton + Sesbainia –Radish (bed) + Hayola transplanted (furrows)	137.3	37.61	75.5	1.818	175736	56415	119321
Cotton + Sesbainia –Wheat (bed) + Linseed (furrows)	87.0	23.85	82.5	1.055	111423	61060	50363
Maize (cobs) + Vegetable Cowpea + sesbania - Mustard +Gram -Green gram	122.5	33.57	90.5	1.354	156835	73140	83695
Sorghum + Cowpeas (fodder)- Wheat + Mustard (9:1) – Cowpeas (Vegetable) + Fodder	159.5	43.69	101.5	1.571	204119	48985	155134

irrigation water). The lowest water productivity value of 0.509 kg grain/m<sup>3</sup> irrigation water was observed with rice-wheat cropping system (Table 2). Low water use efficiency is apparently attributed to excessive use of water and non adoption of appropriate cropping system. Due to continuous adoption of rice-wheat cropping system, indiscriminate exploitation of ground water has been observed which has revised concerns about the long

term sustainability of rice-wheat cropping system besides in-efficient land use. Efficiency has to be improved by introducing diversified cropping system which may also help in improving the factor productivity and farm profitability.

#### **Economic Analysis of different cropping systems**

The net returns were maximum in maize (furrow) + turmeric (bed) - wheat (bed) + linseed (furrow) followed

by maize (furrow) + turmeric (bed) – barley (bed) + linseed (furrow) which was ₹2,89,483 and ₹2,66,177/ha/annum. The maize-potato-spring maize and basmati rice-hayola (transplanted) - summer moongbean system gave 1.37 and 1.55 times more net returns over existing rice-wheat cropping system (Table 2). Similarly in experiment conducted by Sharma *et al.* (2004), net returns were maximum ₹ 1,25,023/ha/ annum in maize-potato-onion system and it was 2.09 times more over rice-wheat system. The net returns were observed to be higher in maize based and basmati rice based cropping systems in comparison to prevailing rice- wheat cropping system.

#### CONCLUSIONS

The study concluded that alternate systems gave better results in terms of productivity and in water use efficiency in comparison to prevailing rice wheat system in Punjab. The results elucidated maximum rice equivalent yield for the cropping system of maize (furrow) + turmeric (bed) – wheat (bed) + linseed (furrow) (282.6 q/ha) which was followed by maize (furrow) + turmeric (bed) - barley (bed) + linseed (furrow) (264.4 q/ha), and basmati rice-radish- spring maize (237.4 q/ha) cropping systems. These cropping systems produced an additional rice equivalent yield of 107 to 152 q/ha and saved 10 to 165 cm irrigation water over the rice-wheat system. Maize (furrow) + turmeric (bed) - wheat (bed) + linseed (furrow) gave highest production efficiency (77.41 kg/day/ha), net returns ₹2,89,483 / ha) and proved to be a viable option to avail higher profitability for farmers in Punjab. The study also made it clear that although there is better option for returns through different cropping systems but still there is need for the enhancement in the initiatives to empower the agriculture in Punjab and to sustain soil health.

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## Protected Cultivation of Tomato in Haryana

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### ABSTRACT

The study revealed that producers obtained maximum share in consumer rupee from direct marketing of tomato i.e. more than 90 percent which may be due to non-existence of market intermediaries between producers and consumers. Whereas least share in consumer's rupee was observed in Channel-IV (Distant market) i.e. 50.04 per cent which may be due to large number of middlemen involved in marketing chain of tomato. As far as marketing efficiency was concerned, Channel-I was found most efficient among all other marketing channels. Lack of poly house/crop insurance schemes to mitigate the risk arising due to damage of crop/structure (84.00 per cent), followed by attack of insect-pest as well as nematodes (80.00 per cent), supply of inferior quality poly-house materials/lack of advice from service providers (80.00 per cent) were found most prominent constraints in the production of tomato under poly house, whereas, lack of market information about prices and demand in different markets (80.67 per cent), non-remunerative prices of produce (76.00 per cent) were also observed as some of the marketing constraints. Keeping in view all these aspects, there is need to provide more support to realize full potential by development of efficient market infrastructure, providing liberal financial support to poly house units/farmers at lower interest rate. Poly house enterprises should be treated as agricultural rather than commercial entity so that emerging poly house enterprise may prove to be more profitable enterprise for the farmers of the state.

### Keywords

National capital region, peri-urban agriculture, protected cultivation, proximity

### JEL Codes

C82, O13, Q12, Q13, Q16

### INTRODUCTION

Tomato is one of the most important "protective foods" because of its special nutritive value. It is one of the most versatile vegetable with wide usage in Indian culinary tradition. Tomatoes are used for soup, salad, pickles, ketchup, puree, sauces and in many other ways. Tomato has very few competitors in the value addition chain of processing. In Haryana, tomato is extensively cultivated in the districts like Yamunanagar, Ambala, Karnal, Sonapat, Jind, Gurgaon and Mewat. Tomato covers approximately 7.6 per cent of the total area under vegetable (356769 ha) cultivation in Haryana. At present, the estimated area and production under tomato is 27070 ha and 417443 tonnes respectively (Report on Model Bankable Project on Protected Cultivation in Haryana, 2012).

Haryana is well suited for the promotion of horticulture, especially in view of its vicinity to the

National Capital Region and other big cities around, besides having easy access to both domestic and external markets. In this context, technology of Protected Cultivation, to grow low volume high value crops, offers great potential to the farmers engaged in peri-urban agriculture. The technology is also scale neutral as it benefits both the large-scale and small scale farmers and ensures higher productivity as well as income (Report of HKA, 2013). Protected cultivation in Haryana is still in a state of infancy, as at present, around 194 ha of area are covered under different protected structures in various regions for producing mainly vegetables and a few floricultural crops. The area under protected cultivation in Haryana is likely to increase fast in near future in the wake of several initiatives under schemes from Central and State Governments. Tomato was found most profitable vegetable crop under poly house cultivation among all other vegetables crops like capsicum and cucumber in

Haryana. Climate change being erratic and unpredictable with available technologies in the state makes it necessary to switch on to a cultivation system which provides protection to the crops against biotic and abiotic stresses envisaged with such changes. The scope of area expansion under cultivation of vegetables and flowers is very little, the only option is vertical expansion through increased productivity and cropping intensity using protected farming with environment control measures, quality seeds, fertilizers and plant protection measures, plastic mulching, protected nursery production, use of green/ polyhouses for off-season production of vegetables and flowers have consistently given good results both at research farms and farmers' fields. Keeping in view all the issues the present study has undertaken in Haryana state in year 2013-14.

**MATERIALS AND METHODS**

The study was conducted in Karnal district of Haryana having the highest number of poly houses in the state. From the district, Gharounda block which has highest number of poly houses (about 50 per cent of the total poly houses of the district) was selected purposively. Fifteen poly houses farmers were selected and interviewed for collection of primary data related to various production and marketing aspects. Two markets namely Karnal and Panipat within study area and distant markets, Azadpur (Vegetables) were selected and five traders each (Wholesaler-cum-Commission agents and retailers) were selected randomly from each selected markets to collect primary data on various marketing aspects. The required secondary data were also collected from State Agriculture Department as well as from Horticulture Department and other related agencies. Simple tabular analysis and Acharya's technique to work out marketing efficiency was applied to analyse the data and to draw the inferences.

**RESULTS AND DISCUSSION**

**Socio-economic profile of selected polyhouse owners**

Average family size was 6.67 persons comprising of 66 per cent adults and 34 per cent children. Majority of the adopters were between the age of 40 to 50 years. About 66 per cent had farming as the main occupation living in joint families. There was high literacy status of polyhouse owners and almost all the selected farmers had acquired education above matriculation. The government incentives/ subsidy (40.00 per cent), farmers interest (26.67 per cent), expected high profitability (20.00 per cent) has proved to be the major factors for adoption of protected cultivation. (Table 1).

**Marketing Channels**

Five marketing channels have been identified that were prevalent in the study area. These channels were adopted by the farmers to dispose of or to market their tomato produce as follows:

- Channel-I: Producer Consumer
- Channel-II: Producer Wholesaler-cum-Commission Agent (CA) Retailer Consumer
- Channel-III: Producer Retailer Consumer

**Table 1: Socio-economic profile of selected polyhouse owners in Karnal district of Haryana**

Particulars	Overall average	Per cent
<b>Average size of family (No.)</b>		
Adults	4.40	65.96
Children	2.27	34.04
Total	6.67	100.00
<b>Age of respondents (Year)</b>		
Below 40	3	20.00
Between 40 to 50	7	46.67
Above 50	5	33.33
<b>Occupation</b>		
Farming household	10.00	66.66
Other	5.00	33.33
<b>Family type</b>		
Joint	9.00	60.00
Nuclear	6.00	40.00
<b>Literacy status</b>		
Below Matriculation	1.00	6.67
Up to Sr. secondary	6.00	40.00
Graduate	6.00	40.00
Post Graduate	2.00	13.33
<b>Motivating factor</b>		
Subsidy	6	40.00
Farmer's Interest	4	26.67
Profit earning enterprise	3	20.00
Following the fellow	2	13.33

Channel-IV: Producer Middleman (Broker) Retailer Consumer

Channel-V: Producer Apni Mandi Consumer

**Marketing cost and price spread in tomato**

Marketing cost plays a crucial role in determining marketing efficiency of agricultural commodities. Analysis of price spread is significant from both producers as well as consumers point of view. An ideal price spread is one where producer gets his due share and at the same time, consumer gets best quality at affordable price. The break-up of price paid by the consumer into different market functionaries and net price received by the producer in sale of tomato through different channels has been depicted in Table no 2. The maximum share of producer in consumer's rupee was in Channel-I (92.50 per cent) and followed by Channel-V (Apnimandi) which was accounted 90.41 per cent. Share of producer in consumer's rupee was lowest (53.04 per cent) in the sale of tomato through Channel-IV(distant markets) involving broker in the supply chain. Marketing cost born by the producer was highest in Channel-IV (15.61 per cent) and lowest in Channel-III (6.13 per cent). Whereas the margin of intermediaries was highest in Channel-III where the retailer got ₹3100 per q (27.55 per cent) out of price paid by the consumer. In absolute terms, the

Table 2: Price spread of tomato grown under poly house

	(₹/q)				
Particulars	Channel-I	Channel-II	Channel-III	Channel-IV	Channel-V
<b>At producer's level</b>					
Net price received by producer	2380	1626	1880	1876	2667
	(92.50)	(55.06)	(60.65)	(53.04)	(90.41)
Marketing cost borne by the producer	193	194	190	552	283
	(7.50)	(6.57)	(6.13)	(15.61)	(9.59)
Sale price of producer in market	-	1820	2070	2428	-
		(61.63)	(66.78)	(68.65)	
<b>At Commission Agent cum wholesaler's level</b>					
Marketing cost borne by trader	-	38	-	180	-
		(1.29)		(5.09)	
Margin	-	99	-	295	-
		(3.35)		(8.34)	
Sale price in the market or purchase price of retailer	-	1957	-	2903	-
		(66.27)		(82.08)	
<b>At retailer's level</b>					
Marketing cost borne by retailers	-	211	176	230	-
		(7.15)	(5.67)	(6.50)	
Margin	-	785	854	404	-
		(26.58)	(27.55)	(11.42)	
Sale price of retailer or price paid by consumer	2573	2953	3100	3537	2950
	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)

Figures in parenthesis represents percentage of consumers price

producer received the highest net sale price in Channel-V (₹2667/q) followed by Channel-I (₹2380/q). Similar results were observed by CSK HPKVP Report (2013)

#### Marketing efficiency of tomato among different marketing channels

Marketing efficiency indicates to what extent the marketing agencies are able to move the goods from producer in the minimum cost, extending maximum service to the consumer. Marketing efficiency of tomato in different existing marketing channels are depicted in Table 3. In the case of tomato, the marketing efficiency was observed higher in the sale through Channel-I (13.33 per cent) followed by Channel-V (10.42 per cent) whereas least marketing efficiency was found in Channel-IV (3.68 per cent).

#### Problems and Constraints

The sampled tomato growers under poly house cultivation faced various problems in production as well as marketing of their produce. Most of respondent farmers expressed lack of polyhouse/ crop insurance schemes to mitigate the risk arising due to damage of structure/crop (84.00 per cent), followed by attack of insect and pest as well as nematodes (80.00 per cent), supply of inferior polyhouse materials/lack of advice from service providers (80.00 per cent), high cost of improved quality seed/seedling material (66.66 per cent), Inadequate power supply and higher charges and scarcity of skilled labor (53.33 per cent), lack of proper guidance from extension agencies (50.67 per cent) as the major production

Table 3: Marketing efficiency of tomato sold through different channels

Particulars	Tomato
Channel-I	13.33
Channel-II	6.67
Channel-III	8.47
Channel-IV	3.68
Channel-V	10.42

problems. Beside these lack of market information about prices and demand in different markets (80.67 per cent), non-remunerative prices of produce (76.00 per cent), time consuming marketing process in distant markets (64.00 per cent), lack of market competition among market functionaries (50.67 per cent) high cost of marketing due to perishable nature of products (48.67 per cent) were observed as marketing constraints. The vegetable growers also reported mal practices adopted by market intermediaries (47.34 per cent) and Lack of proper knowledge about standards for grading (42.67 per cent) in the study area (Table 4). Similar results were observed by Ghanghas *et al.* (2015).

#### CONCLUSIONS

The study was conducted in Karnal district of Haryana having the highest number of poly houses in the state. Required primary as well secondary data were collected from related stakeholders. The study concluded that producers obtained maximum share in consumer rupee in

**Table 4: Problems/constraints faced by tomato growers in protected cultivation**

(N=15)

Particulars	Overall (Per cent)
<b>Production problems</b>	
Lack of polyhouse/crop insurance scheme	84.00
<b>Problems of Nematodes</b>	80.00
Supply of inferior polyhouse materials/Lack of advice from service providers	80.00
<b>High cost of improved quality seed/seedling material</b>	66.66
Scarcity of skilled labour	53.33
Inadequate power supply and higher charges	53.33
Lack of proper guidance from extension agencies	50.67
Lack of adequate and timely supply of inputs	38.00
Non availability required credit for operational expenses	34.00
<b>Marketing problems</b>	
Lack of market information on price and demand in different markets	80.67
Non-remunerative prices of produce	76.00
Time consuming marketing process in distant markets	64.00
Lack of market competition among market functionaries	50.67
High cost of marketing due to perishable nature of products	48.67
Malpractices adopted by market intermediaries	47.34
Delay in payment by traders	46.00
High transportation cost and limited availability of cold chain	44.67
Lack of knowledge about proper packaging and grading techniques	42.67

tomato marketing from direct marketing whether its direct sale to consumer at their own farm gate or sale through Apni Mandi of their produce i.e. more than 90 per cent which may be due to non-existence of market intermediaries between producers and consumers. Whereas least share in consumers rupee were observed in Channel-IV(53.04 per cent)(Distant market) which may due to large number of middlemen involved in marketing chain of tomato. As far as marketing efficiency was concerned, Channel-I was found most efficient among all other marketing channels. Being a highly perishable crop, tomato growers faced problems related to production as well as marketing both. Most of respondent farmers expressed lack of polyhouse/crop insurance schemes to mitigate the risk arising due to damage of structure/crop (84.00 per cent), followed by attack of insect and pest as well as nematodes (80.00 per cent), supply of inferior poly-house materials/lack of advice from service providers (80.00 per cent). Whereas, lack of market information on price and demand in different markets (80.67 per cent), non-remunerative prices of produce (76.00 per cent) were found most prominent constraints in marketing of produce. Keeping in view all the constraints

and opportunities in tomato cultivation under poly houses and close proximity of national capital region of the state. There is need to provide more support to realize full potential by development of efficient market infrastructure, providing liberal financial support at low interest rate. Poly house enterprises should be treated as agricultural rather than commercial entity. So that emerging poly house enterprise proved to be more profitable for the farmers of the state.

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## Economic Impact of Improved Finger Millet Variety (GPU 28) in Karnataka-An Economics Surplus Approach

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### ABSTRACT

The paper attempts to measure the economic impact of new technology by using economic surplus approach. The finding of the study shows that the total economic surplus due to GPU 28 variety of finger millet is ₹1540.38 crores from 1986 to 2010. The consumer's surplus formed 56.13 per cent while the producer's surplus formed 43.87 per cent. Thus, consumers relatively benefited more than producers. The net present value due to GPU 28 ragi (finger millet) is ₹556.91 crores at 5 per cent discount rate yielding an IRR of 79 per cent indicating economic worthiness of investment on ragi (finger millet) research for developing variety GPU 28. The GPU 28 Variety of finger millet has been adopted in more than 50 per cent of finger millet area in Karnataka.

### Keywords

Consumer surplus, economic impact, economic surplus, finger millet

### JEL Codes

C81, O13, Q13, Q16, Q18

### INTRODUCTION

Finger millet (*Eleusine coracana*) crop is grown largely in rainfed areas in India. Finger millet (ragi) is considered as important millet grown in the world and it ranks fourth after sorghum, pearl millet and foxtail millet. It is largely cultivated in Africa, South Asia and China. Africa is the native home of ragi especially the high lands of Ethiopia and Uganda. Measurement of technological contributions in rainfed crops is challenging as accounting for rainfall has no universally approved procedure. For instance, whether to consider the annual rainfall, number of rainy days, variation in rainfall, result in different results. In addition, considering the macro data on productivity of different crops due to input use, seldom considers the data on how irrigation water is provided for and measured. These complexities exacerbate the predicament of over estimation.

In India the State Governments and the ICAR (Indian Council of Agricultural Research) have been funding for agricultural research through the established network of research organizations in the country. This was made possible through committed and continued support to

agricultural research, and the ability of research managers to visualize research challenges and evolve appropriate institutional responses to them (Pal *et al.*, 2005). Agriculture is considered as state subject under Indian constitution. A significant volume of research comes out from the All India Coordinated Research Projects on different crops. Currently there are 61 AICRPs spread all over India. The 'non plan' component of the ICAR is through the All India Coordinated Research Projects in different crops and innovations. The University of Agricultural Sciences, Bangalore has developed the improved variety in finger millet and released in 1997 after a prolonged 11 years research. This variety performing well in field conditions and spread more than half of the total finger millet cropped area. The study was undertaken to assess the economic benefits derived from adoption of improved variety in Karnataka state.

### MATERIALS AND METHODS

To estimate the annual growth rates in area, production and productivity of finger millet the exponential function for the study of the following form was employed,

$$Y = ab^t$$

On applying natural logarithm we will get the equation of the form,

$$\ln Y = \ln a + t \ln b$$

Where,

Y is area, production and productivity,

a is the intercept and

b is the regression coefficient and

t is the time period, the total period (1990-91 to 2010-11).

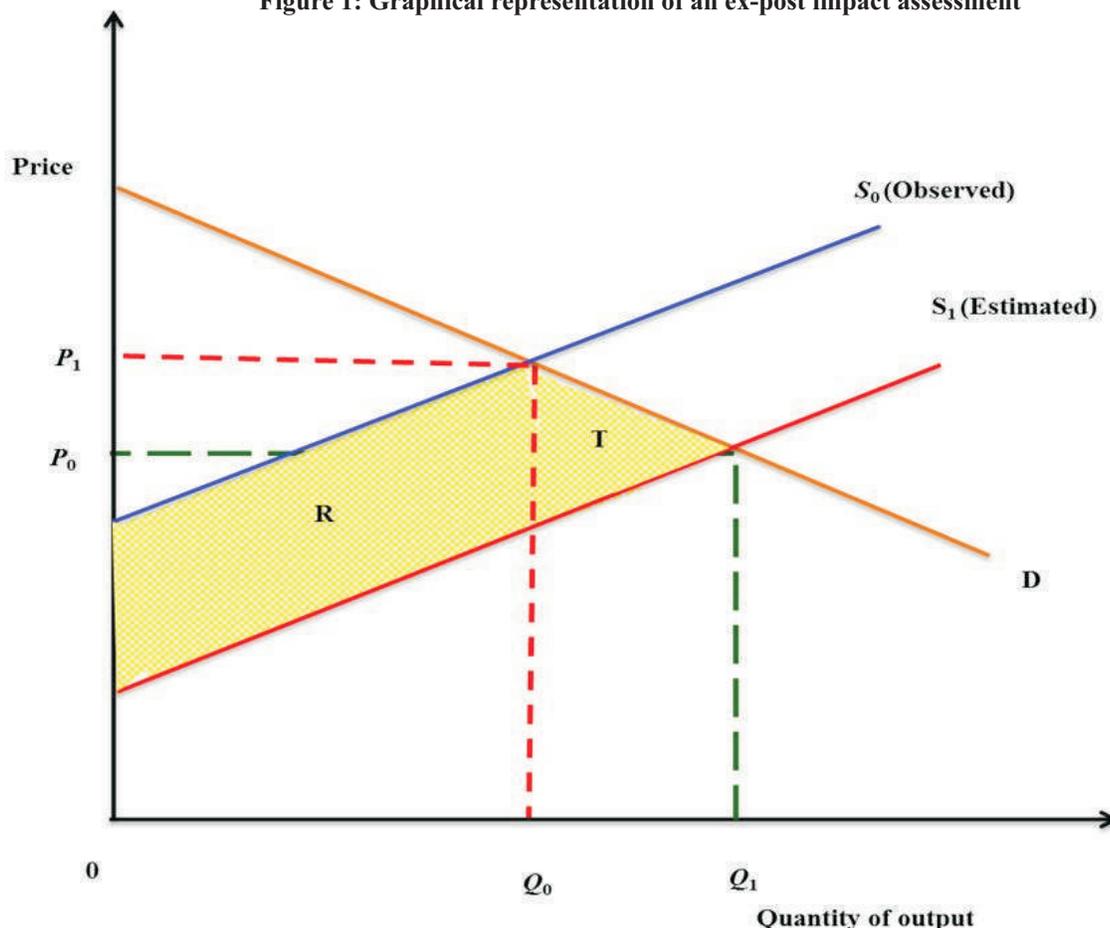
Here compound growth rate is =  $\text{antilog}(\ln b) - 1$ .

Economic surplus by far has been the most popular approach in assessing the impact of investments in agricultural research. This method measures the aggregated social benefit of a research project by calculating consumer and producer surplus due to technological change due to research. The economic surplus along with information on research costs are used to calculate the net present value (NPV), the internal rate of return (IRR) and the benefit-cost-ratio (BCR). Here for impact assessment, the situation with research is compared with the situation without research. This is further dealt using 'with and without' research approach as against 'before and after' research approach for impact assessment of research (Masters *et al.*, 1996). Economic

surplus method provides a relatively simple, flexible approach for economic impact assessment of research, by comparing the situations with and without research.

Data on area, production and productivity of crop over the years from the website <http://eands.dacnet.nic.in/fhprice/FHP-2010-11/karnatak.pdf> on 25/02/2013, 2 pm. The farm harvest prices for years 1997 to 2010 for finger millet are obtained from the website <http://eands.dacnet.nic.in/fhprice/FHP-2010-11/karnatak.pdf> on 25/01/2013. Whole sale price indices for India to deflate the nominal prices were obtained from the website [http://rbidocs.rbi.org.in/rdocs/Publications/PDFs/039T\\_BST130913.pdf](http://rbidocs.rbi.org.in/rdocs/Publications/PDFs/039T_BST130913.pdf) (on 24 Jan 2013); The data on yield due to adoption of new technology and the cost of adoption of new technology was obtained in field work collecting data from sample farmers cultivating check variety and the improved variety. The data on quantity of GPU 28 ragi seeds sold for the years 1997 to 2010 were obtained by adding the sales data from the Karnataka state seeds Corporation, Hebbal, The National Seeds Corporation, Hebbal and the National Seeds Project, UAS, GKVK, Bangalore. Economic parameters-price elasticity of demand and price elasticity

Figure 1: Graphical representation of an ex-post impact assessment



Source: Masters *et al.* (1996)

of supply for a commodity were obtained from Rosegrant *et al.* (2012). Data on research and extension costs incurred for developing the new technology were obtained from concerned scientists for GPU 28 variety.

In the Figure 1 the social gain we wish to measure is area R minus area T. area R shows the social gain due to the reduction in production costs at the observed level of production ( $Q_0$ ), while area T represents a correction for the change in quantity caused by the research (Fig 3.4). The height of area R is measured in terms of money per unit of output. Specifically, the effects of research are observed in terms of quantity of output per unit of input, such as an increased crop yield per hectare. For a given cost of inputs, increased quantities represent a horizontal shift of the supply curve. To adopt the research results we may require additional investment in new inputs. For a given level of output, this increased cost represents vertical shift (Masters *et al.*, 1996). Therefore, it is necessary to combine data on increased quantities (horizontal shift) and increased inputs costs (a vertical shift), to obtain a net shift in terms of costs per unit of output.

In Ex-post impact assessment, which is attempted in this study,  $\Delta Q = Q_1 - Q_0$ , and  $k$  to be the vertical shift in supply. The Social Gain is obtained by the formula

$$SG = kPQ - \frac{1}{2}kP \cdot Q$$

(Masters *et al.*, 1996).

To compute  $k$ ,  $Q$ ,  $I$ ,  $J$  and  $K$  parameters

The steps involved including estimation of welfare gain according to Masters *et al.*, (1996) are as under:

**Step 1:** Data on total production ( $q$ , quintals) of finger millet and price per quintal of ( $P$ , rupees per quintal), for years 1997 to 2010 are obtained for variety GPU28 of Ragi since the variety released during 1997. As the prices obtained are nominal prices, they are deflated to obtain price in real terms by dividing nominal price by wholesale price index. The wholesale price index for different years with base year of 2010 is given in Table appendix I.

**Step 2:** The data on yield of check variety (INDAF 5 for GPU28 Ragi per hectare were collected from  $n = 35$  farmers under each crop variety (including check) through field survey for the year 2011-12. The secondary data on area, production and productivity of finger millet (ragi) is used upto 2010-11. The shift in yield  $Q$  is the difference between the yield of check variety ( $Y_c$ ) and ( $Y_m$ ) the improved variety due to research.

**Step 3:** Estimation of  $J$  parameter

The  $J$  parameter is the total increase in production that is due to adoption of the improved variety (GPU 28 of ragi), assuming that the costs of production / prices of output do not change with the new variety, which is a reasonable assumption.

$J$  is obtained by

$$\Delta Y \cdot t \cdot A \quad \dots (2)$$

Here,

$\Delta Y$  = the yield change =  $Y_c - Y_m$  (in quintals or kgs/ha)

$t$  = adoption rate, assumed / obtained from scientist / breeder concerned

$A$  = Gross area sown in the State under the Ragi crop obtained from the Directorate of Economics and Statistics for each of the years 1997 to 2010 for Ragi.  $J$ -parameter can also be estimated as the change in quantity of output as a share of total output given by  $j = J/Q$  ....(3)

This expression gives the estimate of the supply shift in parameter ( $j$ ) in terms of the increase in yield, rate of adoption and the overall average yield ( $Y$ )

i.e.  $j = (\Delta Y \cdot t) / Y$ . Here,  $Y$  is the overall average yield i.e total production/total area under crop for each year.

**Step 5:** Computation of adoption costs:

The parameter  $I$  is the increase in per unit input cost required to obtain the increase in total production or total output  $J$  (Masters *et al.*, 1996)

$$\text{Given by } I = [\Delta C \cdot t / Y] \quad \dots (4)$$

Here,

$\Delta C$  = adoption costs per ha incurred to adopt the improved variety. This is obtained as the additional cost involved to adopt the new technology variety including all items of additional costs from seed to harvesting.

The proportional cost increase parameter ( $c$ ) is given by,

$$c = I/P = [(\Delta C \cdot t) / Y] \cdot 1/P \quad \dots \dots \dots (5)$$

1. Step 6:  $K$  parameter, or shift in supply curve to be estimated. The  $K$ -parameter is the net reduction in production costs induced by the technology and can be obtained from combining the effects of increased productivity ( $J$ ) and adoption costs ( $I$ ) (Masters., *et al.*, 1996). Given  $J$  and  $I$ , it can be computed using the slope of the supply curve ( $b_s$ ) as

$$K = (J \cdot b_s) - I \quad \dots (6)$$

Step 7: The slopes of supply curves ( $b_s$ ) are associated with units of measurement. Therefore supply elasticity ( $\epsilon$ ), which is independent of units of measurement (Masters., *et al.*, 1996) is computed as follows:

$$\begin{aligned} \epsilon &= \text{per cent } \Delta Q / \text{per cent } \Delta P \\ &= (\Delta Q / Q) / (\Delta P / P) \\ &= (\Delta Q / \Delta P) \cdot (P / Q) \\ &= (1 / b_s) \cdot (P / Q) \end{aligned}$$

$$b_s = \epsilon \cdot Q / P$$

$$K = J / (\epsilon \cdot Q / P) - I \quad K = [JP / \epsilon Q] - I$$

Again  $K$  is used in proportional terms i.e. the net-reduction in production cost as a proportion of the production price, the formula used is given by

$$k = K/P = [JP / \epsilon QP] - I/P = (j/\epsilon) - c \quad \dots (7)$$

where,

$\epsilon$  = price elasticity of supply

To estimate social gains, the elasticity of demand ( $e$ ) price elasticity of supply and demand were obtained from Rosegrant *et al.* (2012).

2. Step 8: The Estimate equilibrium output quantity change:  $\Delta Q$

The equilibrium situation without improved

variety/technology would be that price and quantity, which satisfy both, demand and supply (Masters., et al., 1996):

$$Q_d = Q_s$$

$$P = (a_s - a_d) / (b_d - b_s)$$

Similarly

$$P_1 = (a_s - a_d + b_s K) / (b_d - b_s)$$

$$P = b_s K / (b_d + b_s)$$

the change in quantity is given by

$$Q = b_d \cdot P \quad \dots (8)$$

$$= b_d b_s K / (b_d + b_s)$$

To substitute elasticities for slopes, assume elasticity of demand is e, then

$$e = \text{per cent} \cdot Q / \text{per cent} \cdot P$$

$$= (\Delta Q / Q) / (\Delta P / P)$$

$$= (\Delta Q / \Delta P) (P / Q)$$

$$= b_d (P / Q)$$

$$b_d = e(Q / P)$$

$$\text{Thus } \Delta Q = (eQ/P) \times (\Delta P/P) K / [eQ/P + \Delta P/P]$$

Here we use  $\Delta Q$  in proportional terms, and it is given by the formula

$$\Delta Q = Q e \Delta P / (e + \Delta P) \quad \dots (9)$$

3. Step 9: Next step is to estimate social gains. It is computed using the formula

$$SG = (kPQ) \pm \frac{1}{2} (kP \cdot Q) \quad \dots (10)$$

4. Step 10: we incorporate the costs of research and extension, in real terms (adjusted for inflation), to obtain social benefits for each year. This is done by dividing nominal expenditures by the wholesale price index. The net social benefits are computed by subtracting research and extension costs from the total social gains obtained.

5. Step 11: Net social gain = SG - Research and Extension costs

The producer surplus and consumer surplus is computed by decomposing the Social Gains (SG) given by the equation as follows

$$\Delta TS = \Delta CS + \Delta PS = P_0 Q_0 k (1 + 0.5Ze) \quad \dots (11)$$

$$\Delta CS = P_0 Q_0 Z (1 + 0.5Ze) \quad \dots (12)$$

$$\Delta PS = P_0 Q_0 (k - Z) (1 + 0.5Ze) \quad \dots (13)$$

$$\text{Where } Z = k^* \quad \dots (14)$$

The net social gains obtained from deducting total research and extension costs and it is used to estimate NPV (Net Present Value) and IRR (Internal Rate of Return).

$$\text{Where, } NPV = \sum_{i=1}^n \frac{nB_i}{1 + r^i} \quad \dots (15)$$

Bi = net social gains

r = discount rate, taken as 5 percent (Alston et al., 1995)

i = year 1 to n.

n = total numbers of years of research

## RESULTS AND DISCUSSION

Ragi (finger millet) is an important staple food crop of South Karnataka and is grown in rainfed areas of

Karnataka. Karnataka has the second largest drought area next to Rajasthan. In Eleusine coracana, (finger millet), UASB has been the pioneer in developing and releasing successful varieties since inception. The early successful varieties of ragi (finger millet) belonged to the Indaf series. Using Indaf 5 as the parental variety, the UASB developed GPU 28 with continuous research efforts of 11 years. The GPU 28 was released during 1997. The area under finger millet as observed from the table 1 shows that, it is decreasing continuously at the rate of 1.74 per cent per year. As area is decreasing over the years, the production also has shown a decreasing trend. It is very interesting to note that though the area under crop continuously decreasing but the productivity of finger millet increased at 1.04 per cent per annum from 1990-91 to 2010-11 which indicates the contribution of other factors than conventional inputs for productivity growth.

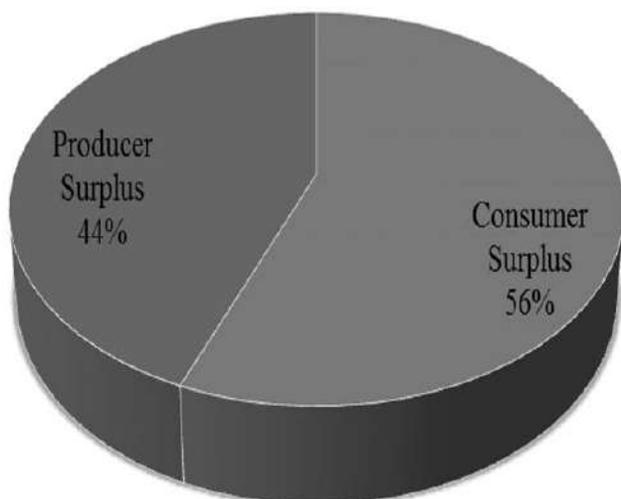
The economic benefits of GPU 28 variety of ragi (finger millet) in Karnataka are presented in Table 2. It is evident that with the assumption of price elasticity of supply 0.528 and price elasticity of demand 0.450 (Rosegrant et al., 2012), the total economic surplus due to GPU 28 variety is 1540.38 crores from 1986 to 2010. The consumers surplus formed 56.13 per cent while the producers surplus formed 43.87 per cent. Thus, consumers relatively benefited more than producers. The net present

**Table 1: Area, production and productivity of finger millet (ragi) in Karnataka: 1990-91 to 2010-11**

Year	Area (ha)	Production (tonnes)	Productivity (kg/ha)
1990-91	1055330	976078	973
1991-92	1118145	1472162	1385
1992-93	1038411	1536132	1557
1993-94	1028508	1566564	1603
1994-95	944155	1352668	1508
1995-96	1019932	1618138	1670
1996-97	1035204	1495149	1520
1997-98	938546	1273013	1428
1998-99	1030679	1734076	1771
1999-00	916328	1402162	1611
2000-01	1022701	1835332	1889
2001-02	953430	1539308	1699
2002-03	767148	714489	980
2003-04	998266	1125093	1186
2004-05	892841	1613873	1903
2005-06	938630	1656306	1858
2006-07	605771	664985	1156
2007-08	832722	1368048	1729
2008-09	841124	1232970	1543
2009-10	764374	1196389	1647
2010-11	787894	1588245	2122
ACGR (Percent)	-1.74	-0.72	1.04

**Table 2: Estimated economic surplus due to Ragi GPU 28 variety in Karnataka for the period 1985-86 to 2009-2010 computed at Price elasticity of demand of 0.45, and price elasticity of supply of 0.53.**

Particulars	Supply elasticity (SE)=0.528 and demand elasticity (DE)=0.45	
	Value	Share
Consumer surplus	864,59,76,227	56.13
Producer surplus	675,78,63,735	43.87
Total economic surplus	1540,38,39,962	100.00
Net economic surplus	1539,69,04,615.	
NPV at 5per cent discount rate	556,90,65,271	
IRR	79 per cent	



**Figure 2: Distribution of economic benefits of GPU 28 variety**

value due to GPU 28 ragi (finger millet) is ₹556.91 crores at 5 per cent discount rate yielding an IRR of 79 per cent indicating economic worthiness of investment on ragi (finger millet) research for developing variety GPU 28. The GPU 28 Variety of ragi has been adopted in more than 50

per cent of ragi area in Karnataka. This is mainly due to the committed and sustainable research and extension efforts of UAS, Bangalore and Department of Agriculture, Karnataka. The increase in economic surplus is mainly due to increased productivity of grain and fodder yield in ragi. The GPU 28 variety not only contributed to productivity of grain but also to productivity of straw. These findings are similar to Bantilan & Joshi (1996). The total economic surplus due to GPU 28 variety is ₹1540 crores from 1986 to 2010. The consumer surplus formed 56.13 per cent of this total, while the producer surplus formed 43.87 per cent. The net present value due to GPU 28 ragi is ₹557 crores at 5 per cent discount rate. The IRR was 79 per cent indicating economic worthiness of investment on ragi research for developing the variety GPU 28.

### CONCLUSIONS

The total economic surplus due to GPU 28 variety is ₹1540 crores from 1986 to 2010. The consumer surplus formed 56.13 per cent of this total, while the producer surplus formed 43.87 per cent. The net present value due to GPU 28 ragi is ₹557 crores at 5 per cent discount rate. The IRR was 79 per cent indicating economic worthiness of investment on ragi research for developing the variety GPU 28.

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Appendix I

Data on area of adoption of GPU 28, adoption rate, adoption cost and proportional increase in production and cost of adoption

Year	Area under ragi (ha)	Area under GPU 28 (ha)	Adoption rate	Mean Yield State (q/ha)	Proportional Production increase	Adoption cost	REAL adoption cost (₹)	Proportional increase in cost
1990	1055330	-	-	9.73	-	-	-	-
1991	1118145	-	-	13.85	-	-	-	-
1992	1038411	-	-	15.57	-	-	-	-
1993	1028508	-	-	16.03	-	-	-	-
1994	944155	-	-	15.08	-	-	-	-
1995	1019932	-	-	16.7	-	-	-	-
1996	1035204	-	-	15.2	-	-	-	-
1997	938546	1880	0.00	14.28	0.00	300.00	606.33	0.00
1998	1030679	12790	0.01	17.71	0.00	350.00	667.66	0.00
1999	916328	80040	0.09	16.11	0.03	370.00	683.47	0.00
2000	1022701	157060	0.15	18.89	0.04	380.00	655.06	0.01
2001	953430	159940	0.17	16.99	0.05	450.00	748.79	0.01
2002	767148	182590	0.24	9.80	0.12	460.00	740.19	0.02
2003	998266	196510	0.20	11.86	0.08	470.00	717.16	0.02
2004	892841	184570	0.21	19.03	0.05	520.00	745.16	0.02
2005	938630	192690	0.21	18.58	0.05	540.00	740.50	0.01
2006	605771	203700	0.34	11.56	0.14	550.00	707.50	0.03
2007	832722	239490	0.29	17.29	0.08	630.00	774.26	0.02
2008	841124	282960	0.34	15.43	0.11	700.00	796.11	0.02
2009	764374	318560	0.42	16.47	0.12	850.00	931.23	0.02
2010	787894	393947	0.50	21.22	0.11	1103.00	1103.00	0.03

Appendix II  
Supply shift due to ragi GPU 28 variety, research and extension cost and social gains

(₹)

Year	Net shift in supply curve $k=(j/E)-c$	Quantity increased (qtls) $Dq = QeEk/(E+e)$	Social gains (₹) $(SG=kPQ - .5kPdQ)$	Research and extension cost	Real cost	Net social gains
1986	-	-	-	84350	422765.38	-422765.38
1987	-	-	-	84350	390947.50	-390947.50
1988	-	-	-	84350	363819.49	-363819.50
1989	-	-	-	94350	378708.14	-378708.14
1990	-	-	-	104350	379873.64	-379873.63
1991	-	-	-	144350	462015.45	-462015.44
1992	-	-	-	184350	536120.27	-536120.27
1993	-	-	-	194350	521637.12	-521637.12
1994	-	-	-	264350	630122.33	-630122.33
1995	-	-	-	320350	707090.66	-707090.66
1996	-	-	-	364350	768803.95	-768803.95
1997	0.00	3570.01	9502496.67	260300	526090.00	8976406.68
1998	0.01	24347.51	72787503.67	260300	496551.18	72290952.45
1999	0.05	153916.50	516759684.70	50000	92360.93	516667323.80
2000	0.07	295459.50	777763411.25	50000	86191.68	777677219.60
2001	0.08	294042.20	746028425.36	60000	99839.14	745928586.20
2002	0.20	346126.80	1075998574.86	45000	72410.31	1075926165.00
2003	0.13	366967.50	988515832.98	-	0	988515833.00
2004	0.08	311886.10	513767863.19	-	0	513767863.20
2005	0.09	353475.20	876405546.58	-	0	876405546.60
2006	0.24	384952.40	1116306874.91	-	0	1116306875.00
2007	0.14	454632.80	1510776944.82	-	0	1510776945.00
2008	0.18	542964.80	2040861425.96	-	0	2040861426.00
2009	0.21	602988.70	2327286705.83	-	0	2327286706.00
2010	0.19	729495.00	2831078672.01	-	0	2831078672.00



## **Correlates of Socio-economic and Psychological Characteristics of the Dairy Farmers with the Adoption of Improved Management Practices**

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### **ABSTRACT**

A field study to examine the correlates of socio-economic and psychological characteristics of the dairy farmers with the adoption improved management practices was conducted. Ex-post facto, a quasi-experimental design was used. A random sampling technique was employed to select the dairy farmers for the study. The investigation was carried out on a set on 60 trained and 60 untrained dairy farmers selected from the three districts namely Bathinda, Mansa and Sri Muksar Sahib of Malwa region of Punjab. The 20 farmers who undergone training from the KVKs of above selected districts during the period of 2011-2013 were selected and referred as trained dairy farmers and for the comparative analysis, an equal matching sample of 20 untrained dairy farmers was also selected from each district. Thus, a sample of 120 dairy farmers was selected for the present study. The adoption was measured in the major four areas such as breeding, feeding, health care and miscellaneous management. The findings revealed that large proportion of the trained dairy farmers (70.00 per cent) were found in medium category of adoption followed by (30.00 per cent) high level of adoption, whereas, the 60.00 per cent of the untrained dairy were in medium category of adoption followed by (36.67 per cent dairy farmers who fell in the low category of adoption. The zero order correlation revealed that the characteristics of the trained dairy farmers such as education, dairy experience, herd size, annual Income, scientific orientation and market orientation were positively and significantly correlated at 0.01 level of probability with the adoption of the dairy practices whereas age and operational land holding, annual income and economic motivation were positively and significantly correlated at 0.05 level of probability. On the other hand, the characteristics of the untrained dairy farmers such as operational land holding herd size and annual income had shown a positive and significant correlation at 0.01 level of probability with adoption of the dairy practices and the family size, economic motivation were positively and significantly correlated at 0.05 level of probability.

### **Keywords**

Adoption, economic motivation ex-post facto, random sampling, scientific orientation, training

### **JEL Codes**

O13, O15, P36, P46, Q16, M53

### **INTRODUCTION**

The livestock sector is inclusive and pro-poor and provides employment & livelihood to a large section of rural population. Moreover, the share of livestock in the agricultural GDP was around 26 per cent in 2010-11 (Lagos and Intodia, 2015). India ranks first in milk production, accounting for 18.5 per cent of world production, achieving an annual output of 146.3 million tonnes during 2014-15 as compared to 137.69 million tonnes during 2013-14 recording a growth of 6.26 per cent. Whereas, the Food and Agriculture Organization (FAO) has reported a 3.1 per cent increase in world milk production from 765 million tonnes in 2013 to 789

million tonnes in 2014. The per capita availability of milk in India has increased from 176 grams per day in 1990-91 to 322 grams per day by 2014-15. It is more than the world average of 294 grams per day during 2013. This represents a sustained growth in availability of milk and milk products for the growing population. Dairying has become an important secondary source of income for millions of rural households engaged in agriculture (Anonymous 2016). Dairy farming has a complementary relationship with agriculture and an integral part of rural life. Dairy is a major occupation for the weaker section of rural community. The bulk of the milk production India is handled by the small, illiterate and poor farmers

(Gangasagare & Karanjar, 2009), who are unaware of the economic benefits of the milk production (Singh & Sastry, 2002). Dairy farming is multifaceted activity which involves breeding, feeding, health care, housing, milk production and general management. For the sound management of the dairy animals, its utmost desirable to adopt the scientific management practices. Even though, country is first in the world's milk production still facing problems in the world food market because of poor quality of milk and milk products. India has developed modern technologies to increase the quality of milk but lagging behind in adoption of these new technologies (Ngongoni *et al.*, 2006). The nation still has potential to meet the growing demand for milk, to increase the country's milk output, judicious strategy of focusing on high yielding breeds and improved management technology should be adopted for considerable dairy development (Quddus, 2012). So, there is an urgent need to sensitize the dairy farmers about the modern technologies and scientific interventions in dairy production to enhance milk yield and milk quality from dairy animals. It is therefore important to determine the relationship existing between socio-economic characteristics of dairy farmers and adoption of improved dairy management practices in Malwa region of Punjab.

**METHODS AND MATERIALS**

A carefully planned and well-documented methodology acts as a torch in the hands of the researcher to carry forward the investigation process. The study was confined to Malwa region of Punjab and conducted in Bathinda, Muktsar and Mansa districts of Punjab. The ex-post-facto research design was selected for the present study as the phenomenon was already occurred. Kerlinger (1973) defined ex-post-facto research as systematic empirical enquiries in which the scientists do not have direct control of independent variables, because their manifestations have already occurred or because they are inherently not manipulable. A random sampling technique was employed to select the dairy farmers for the study. The design formulated for this study consisted of one experimental group and one control group. A list of farmers who acquired specialized training on dairy farming from the KVKs of three selected districts during the period of 2011-2013 was procured and considered as experimental group and farmers who had not undergone any training regarding dairy farming were considered as control group. Out of the list procured from KVKs, 20 trained farmers were selected randomly from each KVK. The equal matching sample of 20 untrained dairy farmers was chosen randomly from these three districts. Hence, 60 trained and 60 untrained dairy farmers constituted the total sample of 120 farmers. The dairy farmers who possessed minimum three dairy animals such as cows/buffaloes or both were considered for the study. The adoption referred to the degree to which the recommended dairy management practices being followed by the dairy farmers. Various statements

pertaining to adoption were selected from the package of practices of GADVASU, Ludhiana. The important dairy management practices were selected in the major areas of breeding, feeding, health care and management based on review of literature and by consulting with dairy specialists of selected KVKs of three districts. Data were collected by the pretested interview schedule by stating the objective of the study to the respondents. During the data collection, every effort was made to receive the unbiased response of the respondents. Both descriptive and inferential statistics were used for the data analysis. The farmers were grouped into low, medium and high based on the mean and standard deviation.

**Co-efficient of Correlation (r):** Karl Pearson's product moment correlation coefficient (1895) (r) was employed to assess the degree of relationship between independent (x) and dependent variable (y). The correlation coefficient is used to measure (i) degree of relationship and (ii) direction of the relationship (positive or negative) between the variables.

**RESULTS AND DISCUSSION**

The adoption of improved dairy farming technology is a unit act but a complex process involving sequence and thought of action. The action of individual farmers is governed by personal, social, economic, psychological and cultural factors involved in situation (Deshmukh and Pagar, 2016). Understanding the dairy management practices followed by farmers is necessary to identify the strengths and weakness of their management to formulate suitable intervention policies (Gupta *et al.*, 2008).

**Level of Adoption of Improved Dairy Practices Management Practices**

Figures pertaining to Table 1 exhibit the adoption of the dairy management practices revealed that large proportion of the trained dairy farmers (70.00 per cent) were found in medium category of adoption followed by (30.00 per cent) high category of adoption. Whereas, the 60.00 per cent of the untrained dairy, were in medium category of adoption followed by the 36.67 per cent who were low category of adoption. Trend exhibited by the figures purpose to think, that it might be due the effect of training availed from KVKs that might have made dairy farmers conscious about the adoption of scientific management practices. Whereas, low adoption amongst the one third untrained dairy farmers also highlights the gap and need to pay attention towards them. Other

**Table 1: Distribution of respondents based on the overall adoption of IDMPs**

Category	(N=120)			
	Trainees (n <sub>1</sub> =60)		Non trainees (n <sub>2</sub> =60)	
	f	Per cent	f	Per cent
Low (<39.71)	0	0.00	22	36.67
Medium (39.71-52.89)	42	70.00	36	60.00
High (>52.89)	18	30.00	2	3.33

researchers like Purushottam *et al.* (2007); Khokhar, (2008); Rizwan *et al.* (2015); Divekar *et al.* (2016) also observed medium level of adoption in their respective areas of investigation.

**Relationship of Socioeconomic Characteristics of Respondents with the Overall Adoption of the Dairy Management Practices.**

Data presented in Table 2 revealed that the characteristics of the trained dairy farmers such as education, dairy experience, herd size, scientific orientation and market orientation were positively and significantly correlated at 0.01 level of probability with the adoption of the dairy practices whereas age and operational land holding, annual income and economic motivation were positively and significantly correlated at 0.05 level of probability. The family size and extension participation were non-significantly associated with adoption of dairy practices.

**Table 2: Relationship of socioeconomic characteristics of respondents with the overall adoption**

Characteristics	Trainees (n <sub>1</sub> =60)		Non trainees (n <sub>2</sub> =60)	
	r	t value	r	t value
Age	0.291**	2.318	-0.007 <sup>NS</sup>	0.050
Education	0.366***	2.995	0.015 <sup>NS</sup>	0.117
Family size	-0.103 <sup>NS</sup>	0.786	0.288**	2.290
Dairy experience	0.386***	3.185	0.044 <sup>NS</sup>	0.337
Operational land holding	0.318**	2.554	0.399***	3.317
Herd size	0.534**	4.808	0.352***	2.868
Annual income	0.315**	2.526	0.398***	3.308
Economic motivation	0.312**	2.500	0.302**	0.241
Scientific orientation	0.320***	2.573	0.185 <sup>NS</sup>	1.109
Market orientation	0.494***	4.329	0.144 <sup>NS</sup>	1.109
Extension participation	0.084 <sup>NS</sup>	0.642	0.227 <sup>NS</sup>	1.77

\*\*\* and \*\* Significant at 0.01 and 0.05 per cent; NS: Non-significant

On the other hand, the characteristics of the untrained dairy farmers such as operational land holding herd size and annual income had shown a positive and significant correlation at 0.01 level of probability with adoption of the dairy practices and the family size, economic motivation were positively and significantly correlated at 0.05 level of probability. However, the age, education, dairy experience, scientific orientation, market orientation and extension participation were non-significantly associated with adoption of dairy practices.

It was found that age of the trained farmers was positively and significantly related with adoption of the dairy enterprises, similar results were observed by Ghosh

*et al.* (2004); Singh *et al.* (2009), whereas it was non significantly related in case of untrained dairy farmers. These findings get consolidated with Ani *et al.* (2004); Arora *et al.* (2006); Khokhar (2008); Rathore *et al.* (2009); Fita *et al.* (2012). Education of trained dairy farmers was found to be positively and significantly related with adoption of dairy practices. (Rahelizatovo *et al.* (2004), Sandeep *et al.* (2006); Halakatti *et al.* (2007); Nichinda and Mendi (2008); Khokhar (2008); Singh *et al.* (2009); Fita *et al.* (2012), whereas the education of untrained dairy farmers was in positive and non-significant association with the adoption of dairy enterprise (Gour, 2002).

Education has profound effect on the adoption of the innovations as it enables the dairy farmers about the relative benefits derived from the adoption of the dairy innovations. It could be inferred that the trained dairy farmers with better educational level had higher adoption than untrained dairy farmers whereas low education level of the untrained farmers might be reason for not having the significant association with the adoption of the dairy enterprise. Dairy experience of the trained dairy farmers had positive and significant relationship with adoption of dairy practices. These findings are in harmony with Fita *et al.* (2012) but was non-significant in the case of untrained dairy farmers. Family size of trained dairy farmers was non significantly associated with the adoption of dairy practices. It was found significantly in case of untrained dairy farmers. Trained farmers might possess independent decision making it might be that increase in family size might be resistance in making the quick decisions. On the other hand, untrained dairy farmers due to low risk taking ability might take decisions in the family. Operational land holding of the trained and untrained dairy farmers was found to be significantly related adoption. It could be inferred that large land holding facilitated to manage dairy in a better way. Herd size of the trained and untrained dairy farmers was also positively and significantly related with adoption of the dairy innovations (Gour, 2002; Khokhar, 2008). It could be inferred that a farmer who owned more number of milch animals might be economically sound which might be a reason behind adoption of the scientific technologies of dairy farming. Annual income of the trained and untrained dairy farmers was found to be significantly related with the adoption of the adoption of dairy practices. It is clear that a farmer with higher annual income would be in condition to adopt the technology faster. Better financial status might have helped the farmers to adopt the technologies.

The psychological trait such as, economic motivation of the trained and untrained dairy farmers was significantly related with adoption of dairy practices. It can be inferred that economic motivation plays vital role in adoption practices of the dairy. Scientific orientation of the trained dairy farmers was significantly (Gour, 2002) whereas it was non significantly associated with adoption

dairy practices. It is clear that farmers with higher scientific orientation would adopt the technologies faster. The market orientation of the trained dairy farmers was positively and significantly (Gour, 2002), whereas, it was non-significantly associated with adoption dairy practices. It could be due to reason that trained farmer with high market orientation would adopt the technologies which yield higher milk and fetch higher revenues. The reason behind the non-significant relationship could be the traditional way of dairying of the untrained dairy farmers. Extension participation of the trained and untrained dairy farmers was non-significantly related with adoption of the dairy practices.

## CONCLUSIONS

Trained dairy farmers were found be medium category of adoption followed by high level whereas, the medium level of adoption of untrained dairy farmers was followed by the low level of the adoption. Based on the findings, it is suggested that earnest efforts are needed to be made to enrich the knowledge level of the farmers regarding the various aspects of the dairy farming such as breeding, feeding, health care and general management of the dairy farm. Regular trainings and camps at village level should be organized to enhance the scientific outlook of the farmers. The provision of the extension services at the doorstep to dairy farmers may serve as a solution to their problems. Adoption of the dairy practices can be enhanced by creating awareness and realizing the farmers about the benefits in terms of social, monetarily gain.

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## Sustainability of Livestock Sector in Punjab

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### ABSTRACT

Livestock sector is one of the most important and fastest growing agricultural subsectors in Punjab. Owing to the changing dynamics of the sector, present study was conducted to assess the sustainability of the sector in the state. The study was carried out for three agro-climatic zones (Zone-I, Zone-II, and Zone-III) for four periods (1997, 2003 and 2007, 2012). Sustainability was measured by developing an index quantifying the basic three pillar model of sustainability; social, economic and ecological dimensions. The results revealed that the sustainability of the state is increasing over the study period. The main reasons attributed are increase in highly productive stock with improvement in ecological externalities. Significant negative trade-off between livestock sustainability and economic sustainability and positive trade-off with ecological was observed. Three scenarios for development of the sector was postulated for three agro-climatic zones in the state. The sector is a viable option for promotion for sustainable income generation among agricultural subsectors in the state.

### Keywords

Agro-climatic zones, livestock, Punjab, sustainability

### JEL Codes

C81, Q01, O13, Q12, Q19

### INTRODUCTION

Globally the livestock sector is intensifying and shifting from pasture-based ruminant species to feed-dependent mono-gastric livestock. This trend had lead livestock production to more intense systems (Galloway *et al.*, 2010). In India, traditionally farmers kept livestock in proportion to the crop residues and labour availability in farms. This practice has undergone rapid change as a transition from subsistence to market oriented production showing that the economic dimension of livestock has assumed significance in household (Kurup, 2000). Serious doubts have been expressed regarding sustainability of these trends as they are population-driven (BIRTHAL, 2000). Though the pressure of human population on land exists, livestock mainly small ruminants such as sheep and goat are blamed for the degradation of common property resources (Mishra, 1993). In the wake of rapid technological progress and changing consumption pattern a sustainable intensification with minimum environmental impact is required. With this purview the present study was carried

out to measure the sustainability of the livestock sector in Punjab.

### Livestock Sector in Punjab

The contribution of livestock sector to the state's GDP is 8.25 per cent and occupies about 31.42 per cent of the state agricultural economy (Anonymous, 2015). The dominant species of livestock in the state include buffalo, cattle, goat and poultry. The region holds high ruminant population intensity and traditional dairy based dietary pattern. The state contributes roughly 2.30 per cent of the total livestock population in the country (Anonymous, 2014). The proportion of workers engaged in livestock sector is as 28.5 per cent of the total agricultural population (Anonymous, 2012).

### METHODOLOGY

#### Concept of Sustainability

The concept of sustainability was defined at various fronts. Brundland report (WCED) in 1987 defined sustainable development as development "meet the needs of present generation without compromising the ability of future generation to meet their own needs". The definition

was extended in Rio Earth summit on 1992, Johannesburg conference on 2002 and Rio +20 conferences on 2012. The basic three pillar model- social, environmental and economic dimensions were coined as quantifiable measure of sustainability. The concept of sustainability is understood as social and economic development with environmental sustainability (Moldan *et al.*, 2012).

Measuring sustainability using composite index are increasingly recognised as a useful tool for policy making (Singh *et al.*, 2009). To assess the sustainability of the livestock sector in the state a composite index was constructed namely Sustainable Livestock Sector Index (SLSI). SLSI encompasses economic, social and ecological dimensions of livestock production based on the three pillar model.

**Rationale for selection of indicators**

Defining sustainability of indicators within the framework of economic, social and ecological dimension is quite complicated and normative. No single indicator can give a complete picture of a dimension. A large number of indicators are required to get a better understanding. Due to the limitations in quantification, data availability and scope of the study the following indicators (Table 1) were taken to conceptualizing different dimensions.

**Economic Sustainability**

For evaluating the economic sustainability of livestock sector, livestock production, productive livestock population and per capita availability of livestock were taken as indicators. Livestock production in terms of milk production (cattle, buffalo and goat), meat production (sheep and goat) and wool production (sheep) were considered. The analogy of this parameter was to capture the major economic output from this sector in terms of quantity. Productive livestock population includes the percentage of productive livestock to the total livestock population. Productive livestock population means number of stock in milk and breeding in case of cattle and buffalo, sheep and goat stock more than

one year of age. Livestock per capita accounts the availability of livestock in accordance with the population. Hence these variables are postulated to be positively linked to economic sustainability.

**Social Sustainability**

Social issues are also central to explain sustainability at the farm level, including the prospects of generational overturn and the manner in which farmers perceive and rate their activity (Ripoll-Bosch *et al.*, 2012). To encapsulate the social sustainability dimension parameters such as literacy rate, veterinary institutions and rural population were employed. These parameters were employed to find the social development existing in the area on par with the livestock sector. Literacy is a basic parameter for social equity and development. Literacy of the social group influences the farmer's decision to keep different livestock (Kumar and Singh, 2008). Veterinary institutes account the accessibility of public to infrastructural facilities for livestock. The livestock support services plays a vital role in enhancing the productive performance of the sector. Rural population is the major holder of livestock stock. Rural population to the percentage of total population ensures the sustained stock of livestock population ensuring availability. Thus these indicators positively contribute to social sustainability.

**Ecological Sustainability**

Ecological sustainability dimension constitutes parameters such as forest cover, livestock diversity, methane emission and livestock intensity. Livestock diversity was calculated by Simpson diversity index. The Simpson Index (SI) is given as

$$SI = 1 - \sum_{i=1}^n P_i^2$$

where,

$$P_i = \frac{A_i}{\sum_{i=1}^n A_i}$$

In the above equations, P<sub>i</sub> and A<sub>i</sub> refer to the proportion

**Table 1: Indicators conceptualizing different dimensions**

Dimensions	Indicators	Operational definition
Economic	Livestock production	Total milk production (Cow, Buffalo, and Goat), Meat production (Goat and Sheep) and wool production (Sheep)
	Livestock productivity	Productivity of major livestock products such as milk (Cow, Buffalo, and Goat), Meat (Goat and Sheep) and wool (Sheep)
	Productive livestock	Percentage of productive livestock to total livestock population
	Per capita availability	Per capita availability of livestock products (milk, meat, wool)
	Infrastructure	Number of veterinary institutes and permanent dispensaries
Social	Literacy rate	Percentage of literate population
	Rural population	Percentage of rural population to total population
Ecological	Forest cover	Areas under natural vegetation cover (forest area).
	Livestock diversity	Variability of livestock at genes level.
	Methane emission	Estimated methane emission of total livestock (Singh <i>et al.</i> , 2012).
	Livestock density	Livestock per sq km area & Total Cultivated Area (TCA)

of the  $i^{th}$  crop and the area under the  $i^{th}$  crop (ha) respectively. The value of Simpson's Index ranges between zero and one; zero denotes complete specialization whereas one denotes perfect diversification.

Forest cover accounts the total forest area in this state as it has the major share of Common Property Resources (CPRs) in the state. It stands as a buffering component and CPRs hold positive relation to sustainability. Livestock diversity holds positive trade-off with the sustainability (Hoffman, 2011). Livestock is the major source of methane emission in India (Chhabra *et al.*, 2009). It has a negative externality to the ecology. Livestock intensity measures the livestock per sq km of area and total cropped area. It gives the account the carrying capacity of livestock. More the intensity more the pressure it exerts on the ecology. Increases in livestock density are likely to bring high risks of negative environmental impact (Neumann *et al.*, 2011). Thus it has negative impact on the ecological sustainability.

**Index development**

Index development was adopted from studies carried out by several scholars (Iyengar & Sudarshan 1982; Shi and Gill 2005; Singh *et al.*, 2009; Sen & Hatai 2008; Chand *et al.*, 2011; Chand & Sirohi 2012). The SLSI was constructed using eleven indicators. Each indicator (variable) having positive effect with SLSI will be indexed ( $I_{ijk}$ ) as

$$I_{ijk} = \frac{X_{ijk} - \text{Min } X_{ijk}}{\text{Max } X_{ijk} - \text{Min } X_{ijk}}$$

And for indicators which are having negative effect with SLSI will be indexed ( $I_{ijk}$ ) as

$$I_{ijk} = \frac{\text{Max } X_{ijk} - X_{ijk}}{\text{Max } X_{ijk} - \text{Min } X_{ijk}}$$

Where,  $X_{ijk}$  value of  $i$ th year representing  $j$ th variable of  $k$ th region. The calculated index for each indicator  $I_{ijk}$  is used to calculate the indices for various components of SLSI, i.e. Economic Sustainability Index ( $ESI_1$ ), Social Sustainability Index (SSI) and Ecological Sustainability Index ( $ESI_2$ ) as the weighted mean of respective indices. The weights were calculated by the formula given by Iyengar and Sudharshan (1982).

$$W_j = \frac{\sum_{j=1}^m \left( \frac{1}{\sqrt{\text{Var } (I_{ijk})}} \right)^{-1}}{\sqrt{\text{Var } (I_{ijk})}}$$

Where  $W_j$ 's, lies between 0 and 1 ( $0 < W < 1$ ) and  $\sum W_j$  equal to one. The weights thus calculated were used for working out the weighted mean for each components of sustainability ( $ESI$ ,  $SSI$  and  $ESI$ ) and SLSI. It could mathematically notate as;

The composite index for each region will be calculated

$$ESI_{1ik} = \sum_{j=1}^m W_j I_{ijk}$$

$$SSI_{1ik} = \sum_{j=1}^m W_j I_{ijk}$$

$$ESI_{2ik} = \sum_{j=1}^m W_j I_{ijk}$$

as

$$SLSI_{ik} = (W1*ESI_{1ik} + W2*SSI_{ik} + W3* ESI_{2ik} )$$

The choice of weights in this manner ensured that large variation in any one of the indicators did not unduly dominate the contribution of the rest of the indicators.

**Categorization of the sustainability indices**

Simple ranking of the sustainability could give a spatial comparison. But to understand the extent of sustainability categorization into different stages are required. Such a categorization was obtained by assuming it in a probability distribution. One such probability distribution which is widely used is beta distribution. The probability density function of beta distribution is given by,

$$f(z) = \frac{z^{a-1} (1-z)^{b-1}}{\beta(a,b)}$$

Where  $0 < z < 1$  and  $a, b > 0$ .  $\beta(a,b)$  is the beta function defined by

$$\beta(a,b) = \int_0^1 x^{a-1} (1-x)^{b-1} dx$$

The two parameters  $a$  and  $b$  of the distribution was estimated using XLSTAT software package.

The distribution is then divided into linear intervals (0,z1), (z1,z2), (z2,z3), (z3,z4) and (z4,1). This fractile interval was used to categorize into various categories.

Least Sustainability	if	$0 < x_{ijk} < z1$
Low Sustainability	if	$z1 < x_{ijk} < z2$
Medium Sustainability	if	$z2 < x_{ijk} < z3$
High Sustainability	if	$z3 < x_{ijk} < z4$
Higher Sustainability	if	$z4 < x_{ijk} < 1$

Where,  $x_{ijk}$  is the calculated  $ESI_1$ ,  $SSI$ ,  $ESI_2$  and  $SLSI$  values.

**Data source**

The study was undertaken on a macro framework based on secondary data. The data on various variables was collected from different years of Statistical Abstracts of Punjab, Economic Survey of India and Punjab, Livestock Censuses of Punjab from Department of Animal Husbandry, Chandigarh, Punjab. The data for the study was collected from four periods (1997, 2003 and 2007, 2012) coinciding with the livestock census periods. The period was limited from 1997 till 2012 due to discrepancy in data collection format before 1997 and 2012 being the last census data available.

**RESULTS AND DISCUSSION**

**Sustainability of livestock sector in Punjab**

The sustainability of livestock sector in Punjab for different census periods is depicted in Table 2. On a scale

of 0 to 1, the mean value of SLSI came out to be 0.469 and C.V of 8.182 per cent for the state over the census periods 1997, 2003, 2007 and 2012. The SLSI was found to be increasing over the period. It was 0.424 in 1997, 0.458 in 2003, 0.476 in 2007 and 0.516 in 2012. Similar trend was witnessed in all the three dimensions, except for Social dimension which had decreased from 0.507 to 0.497 in 2007 and further to 0.473 in 2012. Other dimensions such as Economic increased from 0.432 in 1997 to 0.504 in 2012, while ecological dimension increased from 0.420 in 1997 to 0.635 in 2012. The increase in the SLSI is mainly due to the increase in this dimension of sustainability.

**Table 2: Sustainability of livestock sector in Punjab**

Census period	ESI <sub>1</sub>	SSI	ESI <sub>2</sub>	SLSI
1997	0.432	0.414	0.420	0.424
2003	0.419	0.507	0.489	0.458
2007	0.439	0.497	0.556	0.476
2012	0.504	0.473	0.651	0.516
Mean	0.448	0.472	0.529	0.469
C.V	8.482	8.825	18.655	8.182

Source: Calculated by authors

**Sustainability of livestock sector in different agro-climatic zones of Punjab**

The sustainability of livestock sector in different agro-climatic zones of Punjab was worked out and is presented in Table 3. The inter-zonal variations were not very sharp (C.V: 10.943 per cent) across the state over the census periods. Among the zones, the highest score of sustainability moved from zone-III to zone-I. In 1997, the highest score of sustainability was recorded in zone-III (0.459), but later 2003, 2007 and 2012 it was found to be higher in zone-I. There was a varying trend observed in social, economic and ecological dimensions of

**Table 3: Sustainability of livestock sector in different agro-climatic zones of Punjab**

Census period	Zone	ESI <sub>1</sub>	SSI	ESI <sub>2</sub>	SLSI
1997	Zone-I	0.376	0.437	0.729	0.450
	Zone-II	0.324	0.587	0.023	0.364
	Zone-III	0.597	0.217	0.507	0.459
2003	Zone-I	0.431	0.507	0.785	0.510
	Zone-II	0.354	0.641	0.216	0.426
	Zone-III	0.471	0.371	0.465	0.437
2007	Zone-I	0.420	0.487	0.820	0.503
	Zone-II	0.394	0.601	0.308	0.448
	Zone-III	0.502	0.403	0.541	0.476
2012	Zone-I	0.486	0.460	0.942	0.547
	Zone-II	0.540	0.616	0.376	0.540
	Zone-III	0.487	0.342	0.635	0.462
Weights		0.520	0.326	0.154	
Mean		0.448	0.472	0.529	0.469
C.V		17.854	27.016	51.087	10.943

Source: Calculated by author's

sustainability. The mean value of socio-economic sustainability index was 0.448 with low variation among dimensions (C.V: 17.854) across the state over the period. Higher economic sustainability index (ESI<sub>1</sub>) was observed in zone-III for the periods 1997, 2003 and 2007. But in 2012, the ESI<sub>1</sub> was higher for zone-II. The SSI values observed to be increasing till 2003 and later saw a decline in 2012 for zone-III. Ecological sustainability index (ESI<sub>2</sub>) had a mean value of 0.529 with high variation (C.V: 51.087) among the zones over the periods.

The results therefore revealed that the sustainability of the livestock sector was found to be increasing over the period which might be due to the increase in economic and ecological indicators. The variation in SLSI was mainly due to the variation in SSI. In zone-I, ESI was found to be the highest because of the hilly terrain and more ecological sound area which in Zone-II was lowest as it has the highest exploited fertile belt in Punjab.

**Correlation Between the Sustainability Dimensions**

The correlation coefficients among the SLSI and its dimensions are shown in Table 4. High significant correlation was obtained between the Economic and ecological dimensions and SLSI. The correlation between SSI and ESI<sub>1</sub> was -0.640 and the correlation between ESI<sub>2</sub> and SLSI was 0.727. This means there exists negative trade-off between economic and social dimensions and positive trade-off of ecological with SLSI.

**Table 4: Correlation between sustainability components**

	ESI <sub>1</sub>	SSI	ESI <sub>2</sub>	SLSI
ESI <sub>1</sub>	1			
SSI	-0.6408** (0.0248)	1		
ESI <sub>2</sub>	0.3315 (0.2925)	-0.4295 (0.1634)	1	
SLSI	0.5609* (0.0578)	-0.0549 (0.8655)	0.7277*** (0.0073)	1

\*\*\* significant at 1 per cent, \*\*significant at 5 per cent, \*significant at 10 per cent. The values in parenthesis are p-values

The score of SLSI gives only the summary picture of relative sustainability of livestock in Punjab. The components of indices could provide greater insight into the three dimensions of sustainability.

**Indices Values of Economic Sustainability Indicators for Different Agro-climatic Zones in Punjab**

The indices values of different variables used to calculate ESI<sub>1</sub> is given in Table 5. Livestock production was high in Zone-III for all the periods, but in 2012 it was higher in Zone-II (0.554). This was mainly due to increase in the percentage of productive livestock in this region. Though the per capita availability of livestock products was high in zone-III, it was observed to be declining in succeeding zones. The highest percentage of productive stock was observed in zone-I and found increasing over period. Higher C.V was observed for livestock production and per capita availability of livestock products (milk,

meat, wool).

**Indices Values of Social Sustainability Indicators for Different Agro-climatic Zones in Punjab**

The indices values of different variables used to calculate ESI<sub>1</sub> is given in Table 6. The highest literacy was recorded in zone-I. The institutional support for livestock rearing was found to be high in zone-II, while highest rural population was observed in zone-I. These variations and irregular pattern contributed to the variation of SSI. Higher variations were observed in the variables such as literacy (47.13 per cent), veterinary institute (99.34 per cent), permanent dispensaries (103.81 per cent) and rural population (66.14 per cent).

**Indices Values of Ecological Sustainability Indicators**

**for Different Agro-climatic Zones in Punjab**

The ESI score for different agro-climatic zones are given in Table 7. The higher value of forest cover, livestock diversity, methane emission and density was observed in zone-I resulting in higher value of ESI in all the periods. The variables recorded high variation among the zones over the period. Forest area had a mean value of 0.376 with variation of 116.50 per cent. Livestock diversity had a mean value of 0.267 with variation of 139.46 per cent. Methane emission index had a mean of 0.630 and variation of 50.96 per cent. Livestock density expressed in terms of livestock per sq km area and TCA had a mean of 0.619 and 0.676 with variations 48.562 and 49.710 respectively.

**Table 5: Indices values of economic sustainability indicators**

Year	Zone	Livestock production	Per capita availability	Livestock productivity	Percentage of productive livestock
1997	Zone I	0.051	0.201	0.520	0.528
	Zone II	0.543	0.160	0.207	0.441
	Zone III	0.765	1.000	0.552	0.266
2003	Zone I	0.049	0.167	0.678	0.554
	Zone II	0.258	0.024	0.449	0.527
	Zone III	0.440	0.450	0.614	0.327
2007	Zone I	0.081	0.171	0.627	0.554
	Zone II	0.425	0.114	0.459	0.484
	Zone III	0.506	0.457	0.525	0.503
2012	Zone I	0.064	0.148	0.686	0.744
	Zone II	0.554	0.152	0.534	0.806
	Zone III	0.416	0.358	0.529	0.568
	Weights	0.182	0.192	0.347	0.279
	Mean	0.333	0.276	0.517	0.506
	C.V	72.161	94.899	24.681	29.523

*The indicators are average of the products (milk, meat, wool) as well as livestock type (indigenous cow, cross bred-cow, buffalo, sheep and goat). Source: Calculated by author's*

**Table 6: Indices values of social sustainability indicators**

Census period	Zone	literacy	Veterinary institutes	Permanent dispensaries	Rural population
1997	Zone-I	0.565	0.000	0.036	1.000
	Zone-II	0.390	0.744	1.000	0.328
	Zone-III	0.000	0.003	0.132	0.710
2003	Zone-I	0.887	0.139	0.010	0.809
	Zone-II	0.707	1.000	0.890	0.057
	Zone-III	0.366	0.269	0.214	0.596
2007	Zone-I	0.871	0.081	0.052	0.763
	Zone-II	0.668	0.886	0.776	0.138
	Zone-III	0.380	0.350	0.296	0.564
2012	Zone-I	1.000	0.067	0.000	0.572
	Zone-II	0.846	0.883	0.776	0.000
	Zone-III	0.607	0.194	0.210	0.280
Weights		0.295	0.221	0.222	0.263
Mean		0.607	0.385	0.366	0.485
C.V		47.13	99.34	103.81	66.14

*Source: Calculated by author's*

**Categorization of the Sustainability Indices**

SLSI was categorised in to five different categories based on beta distribution of the data (Table 8). The categorizations of sustainability according to the agro-

climatic zones are given in Table 9. In general, the livestock sustainability was found to be of medium category. The economic dimension showed high sustainability while social and ecological dimension

**Table 7: Indices values of ecological sustainability indicators**

Census period	Zone	Forest cover	Livestock diversity	Methane emission	Livestock density per total area	Livestock density per TCA
1997	Zone-I	0.919	0.107	0.890	0.878	0.810
	Zone-II	0.143	0.000	0.000	0.000	0.000
	Zone-III	0.000	0.049	0.710	0.614	0.980
2003	Zone-I	1.000	0.109	0.976	0.930	0.869
	Zone-II	0.162	0.016	0.229	0.286	0.346
	Zone-III	0.019	0.048	0.629	0.607	0.853
2007	Zone-I	0.986	0.161	1.000	1.000	0.899
	Zone-II	0.162	0.030	0.418	0.457	0.389
	Zone-III	0.019	0.062	0.733	0.696	1.000
2012	Zone-I	0.948	1.000	0.956	0.943	0.868
	Zone-II	0.128	0.766	0.343	0.385	0.239
	Zone-III	0.024	0.855	0.679	0.637	0.856
Weights		0.159	0.187	0.216	0.231	0.207
Mean		0.376	0.267	0.630	0.619	0.676
C.V		116.500	139.460	50.963	48.562	49.710

Source: Calculated by author's

**Table 8: Categorization of the sustainability indices**

Categories	ESI	SESI	ESI	SLSI
Least sustainability	0 to 0.30	0 to 0.44	0 to 0.20	0 to 0.40
Low sustainability	0.30 to 0.40	0.44 to 0.46	0.20 to 0.40	0.40 to 0.45
Medium sustainability	0.40 to 0.45	0.46 to 0.48	0.40 to 0.60	0.45 to 0.50
High sustainability	0.45 to 0.50	0.48 to 0.50	0.60 to 0.80	0.50 to 0.55
Higher sustainability	0.55 to 1.00	0.50 to 1.00	0.80 to 1.00	0.55 to 1.00

Source: Calculated by author's using XLSTAT

**Table 9: Categorization of sustainability of livestock sector in different agro-climatic zones of Punjab**

Census period	Zone	ESI	SSI	ESI	SLSI
1997	Zone-I	Low	Medium	Higher	Low
	Zone-II	Low	Higher	Low	Least
	Zone-III	Higher	Least	Medium	Medium
2003	Zone-I	Medium	High	Higher	High
	Zone-II	Low	Higher	Low	Low
	Zone-III	High	Low	Medium	Low
2007	Zone-I	Medium	High	Higher	High
	Zone-II	Low	Higher	Low	Low
	Zone-III	Higher	Low	Medium	Medium
2012	Zone-I	High	Medium	Higher	High
	Zone-II	Higher	Higher	Low	High
	Zone-III	High	Low	High	Medium
Overall		High	Medium	Medium	Medium

Calculated index values categorised base on table 8.

Source: Categorised by author's

showed medium sustainability over the periods in the state.

The economic sustainability index (SESI) was found to be low in zone-I and zone-II and higher zone-III in 1997. But by 2012, it was high in zone-I and zone-III and higher in zone-II. This quantum jump in zone-II is mainly due to increase in livestock production due to increase in population of productive cows in this region. The SSI had fluctuated in zones throughout the period. Though social status of the people are improving infrastuctual support is declining in this region. The ecological sustainability index though increased in value terms the categories almost remained the same; Zone-I showed higher sustainability while zone-II showed low sustainability and zone-III showed medium sustainability. The overall SLSI categories showed improvement over the period. It was mainly guided by ESI. Zone-I increased from low sustainability in 1997 to high sustainability in 2003. Zone-II showed a gradual advancement from least sustainability to low sustainability in 2003, to high in 2012. Zone-II being agriculturally advanced district with higher cropping intensity and irrigated area showed higher sustainability. Ecological sustainability was also found to be higher in mountainous zones. Such observations were in consonance with similar studies carried out in Rajasthan (Chand *et al.*, 2011; Chand and Sirohi, 2012).

## CONCLUSIONS

The results revealed that the sustainability of livestock sector in this state was found to be increasing over the period. This was mainly due to the reduction in number but higher production with high productive stocks and low environmental externalities. This sector was found to be highly sustainable based on the three pillar model. Significant trade-off between sustainability and its dimensions (socio, economic and ecological) was also observed. The study has given us three scenarios of development of livestock sector in the three agro-climatic zones of the state. Zone-I being the most sustainable one which could be promoted for the development of livestock sector as this zone showed more ecological sustainability. Policies such as introduction of new cross-breeding programmes, establishment of livestock farms can be promoted in this region for sustainable development of livestock sector in this region. Zone-II recorded high sustainability in spite of its low ecological sustainability in this region. For sustainable development of livestock sector in this region emphasis should be given to improve the ecological dimension. This could be done by increasing the forest area from existing seven per cent to warranted 14 per cent of the geographical area, encouraging more productive livestock so that the pressure on natural resources can be reduced. Such emphasis can be also given in zone-III where both economic and ecological dimensions are as good as zone-I and zone-II respectively and emphasis is needed on social support. Overall the livestock sector in Punjab was

showing increasing sustainability, so it could be promoted as a sector for diversification in agricultural and allied sector.

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## Impact Assessment on Adoption of Weed Management Practices in Sugarcane by the Farmers in Madhya Pradesh

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### ABSTRACT

The study was undertaken with the objective to assess the impact on the basis of adoption of weed management practices before and after intervention. In order to achieve the objective of the study five villages from Saikheda block were selected randomly. Finding of study revealed that 67.86 per cent farmers had their own tractor and 70.53 per cent had owned hand operated sprayer. The area under sugarcane crop is increases after intervention of weed management practices and productivity of sugarcane crop was also increased after intervention. It is also revealed from study that before intervention 73.64 per cent farmers used Bakhar for mechanical control of weeds and after intervention 88.39 per cent used tractor drawn implement to control weeds while none of the farmers adopted chemical control method before intervention and after intervention majority of farmers (88.00 per cent) applied 24-D only whereas 12.00 per cent farmers applied 2, 4-D and Metribuzin both to control weeds.

### Keywords

Adoption, chemical control, impact assessment, mechanical control, weed management

### JEL Codes

Q01, Q15, Q17, Q55, Q56

### INTRODUCTION

Sugarcane (*Saccharum officinerum* L.) is grown under widely dispersed agro climatic zones around the world. It is the main source of sugar besides it provides biofuel, fibre and fertilizer. According to FAO report 2011 sugarcane occupies an area of 25.44 million ha with a total production of 1794 million metric tons. India is second largest sugarcane producing country after Brazil, cultivated in 5.09 million ha area with a production of 357.67 million tonnes. Sugarcane is grown mainly in the states of Maharashtra, Karnataka, Gujarat, Tamil Nadu, Uttar Pradesh, Punjab, Haryana and Bihar in which about 43 per cent area alone occupies by the Uttar Pradesh of the total area but in terms of productivity, Tamil Nadu leads with 104 tons/ha which is higher than the national average productivity of 68.6 tons/ha (Singh & Bhosale, 2014). In Madhya Pradesh total cultivated area is 73.10 thousand hectare with 361.30 thousand tones out of which Narsinghpur district comprises 28.60 thousand hectare area with 142.00 thousand tone production and 4970 kg/ha productivity (www.mprkshi.org).

Due to wider row space and slow initial growth

sugarcane provides ample opportunity for weeds to occupy vacant space between rows and offer serious competition to crop. With nutrient removal, weeds reduce sugarcane yield more than the other pests. It is reported that yield loss caused by weeds may range from 25-50 per cent depending upon the nature and intensity of weeds (Rao *et al.*, 2014). Sugarcane is infected by grasses, broad leaf weeds and sedges pose big challenge for sugarcane production. The major weeds are *Sedgesa Cyperus rotundus*, grasses *Cynodon dactylon*, *Sorghum halepense*, *Panicum spp.*, *Dactyloctenium aegyptium*, broad leaves weed *Chenopodium album* L., *Amaranthus viridis* L., *Portulaca oleracea* L., *Commelina benghalensis* L., *Trianthema Portulacastrum* L. (Status paper on Sugarcane, Directorate of Sugarcane Development 2013), etc. The initial 90 to 120 days period of crop growth is most critical period of weed competition and therefore weed free condition during these days must be give higher yield. So proper weed management practices keep weed free field and ensure higher production of sugarcane. Manual weeding, mechanical weeding and chemical methods are mostly used to control weeds in

sugarcane. Manual weeding almost a clean weed free field but is highly labour demanding and time consuming operation. Chemical control method deteriorates soil health and may have residual effect on crop and soil. Chemical control method and manual weeding leads to increases cost of production. Because of this reason as well as concern over environmental degradation, mechanical method of weed control is gaining popularity over manual and chemical methods. It is very effective, less time consuming and eliminates drudgery involved in manual weeding. The present study was, therefore, undertaken to compare before and after intervention adoption of integrated weed management practices.

**MATERIALS AND METHODS**

The Present investigation was conducted in Narsinghpur district (Madhya Pradesh). Out of the six blocks, namely Saikheda was selected randomly. From the Saikheda block five villages *Khairi, Gardha, Kamti, Pitthera* and *Khursipar* were selected randomly. The farmers were selected by proportionate random sampling method to make sample size 112. Data were collected by personal interview method with the help of pretested structured interview schedule. Interview was conducted at residence of respondent as well as on the farm of the respondents. The data were analysed by using descriptive statistical tools.

**RESULTS AND DISCUSSION**

**Table 1: Owned farm power sources**

Particulars	Frequency	Percent
Bullock pair	5	4.46
Tractor	76	67.86
Plough	19	16.96
Ridge and furrow maker	26	23.21
Cultivator	74	66.07
Rotavator	6	05.35
Hand operated sprayer	79	70.53
Tractor operated sprayer	17	15.17

Farm powers are number of implement possessed by the farmer and facilitate agricultural operations. Majority of farmers 67.86 per cent had tractor and 66.07 per cent had cultivator. However, 23.21 per cent farmers had ridge

and furrow maker, 16.96 per cent had plough, 5.35 per cent had rotavator and only 4.46 per cent farmers had bullock pairs. It also shown that 70.53 per cent farmers had hand operated sprayer and 15.17 per cent had tractor operated sprayer.

Distribution of selected farmers according to their area under sugarcane crop has been presented in Table 2. Before intervention of weed management practices out of total selected farmers, 110 farmers cultivated sugarcane. The actual area before intervention of weed management practices under sugarcane crop up to 1 ha was observed with 33.64 per cent farmers, 1.01 to 2.00 (38.18 per cent), 2.01 to 3.00 ha (16.36 per cent), 3.01 to 4.00 ha (7.27 per cent), 4.01 to 5.00 ha (1.82 per cent) and above 5 ha area under sugarcane crop was observed with only 2.73 per cent farmers. After intervention it is depicted from data up to 1 ha was observed with 20.54 per cent farmers, 1.01 to 2.00 ha (41.96 per cent), 2.01 to 3.00 ha (16.07 per cent), 3.01 to 4.00 ha (10.71 per cent) and same percentage of farmers (5.36 per cent) were in 4.01 to 5.00 ha and above 5 ha categories. In case of percentage change negative change occur in area of sugarcane up to 1 ha (-38.94 per cent) and 2.01 to 3.00 ha (-01.77 per cent) whereas positive change occurs in 1.01 to 2.00 ha (+09.90 per cent), 3.01 to 4.00 ha (+47.11 per cent), 4.01 to 5.00 ha (+196.13) and above 5 ha (+96.33). Thus it can be concluded that after intervention area of sugarcane is increased than before intervention.

The perusal of the results presented in Table 3 revealed that before intervention 90.91 per cent farmers come under the range of 500-650 q/ha productivity followed by 10.00 percent (651-800 q/ha) while after intervention productivity of sugarcane crop has been increased that is 36.61 per cent farmers come under the range of 951-1100q/ha followed by 28.57 per cent (801-950q/ha), 24.11 per cent (651-800 q/ha) and 10.71 per cent (1101-1250 q/ha). It can be concluded that due to better weed management practices and other agronomic operations yield of sugarcane is increased.

It can be furnished that before intervention of weed management practices majority of respondent 73.64 per cent doing mechanical weeding by Bakhar. Mechanical weeding was done by the 89.10 per cent farmers in 3

**Table 2: Area under sugarcane crop**

Area (ha)	Before intervention		After intervention		Per cent change
	Frequency n <sub>1</sub> = 110	Per cent	Frequency N= 112	Per cent	
Up to 1.00	37	33.64	23	20.54	-38.94
1.01-2.00	42	38.18	47	41.96	+09.90
2.01-3.00	18	16.36	18	16.07	-01.77
3.01-4.00	8	7.27	12	10.71	+47.11
4.01-5.00	2	1.82	6	5.36	+196.13
Above 5.00	3	2.73	6	5.36	+96.33
Total	110	100.00	112	100.00	

**Table 3. Productivity of sugarcane crop**

Productivity (q /ha)	Before intervention		After intervention	
	Frequency n <sub>1</sub> = 110	per cent	Frequency N = 112	per cent
500 -650	100	90.91	-	-
651- 800	10	9.09	27	24.11
801- 950	-	-	32	28.57
951-1100	-	-	41	36.61
1101-1250	-	-	12	10.71
<b>Total</b>	<b>110</b>	<b>100.00</b>	<b>112</b>	<b>100.00</b>

times. Maximum respondents 68.18 per cent doing one mechanical weeding at 45 DAS while higher percentage of respondents 57.27 per cent doing one mechanical weeding in 3 days. Among total selected farmers higher

percentage (73.64 per cent) required 1 labour.

Whereas, after intervention of weed management practices majority of respondents 88.39 per cent done weeding by Tractor drawn implements. The appropriate reason to more use of tractor is that day by day mechanization is trending and scarcity of labour is also one of the reasons. Due to use of these implements farmers can also save their times. The higher percentage of respondents 55.36 per cent done weeding in 3 times while 72.32 per cent done one mechanical weeding at 60 DAS. While considering the time requirement for one mechanical weeding it was observed that majority of respondents 88.39 per cent take 2.5 hour for one weeding. Near to hundred per cent 99.11 per cent farmers required 1 labour for 1 mechanical weeding.

The data regarding adoption of herbicide application practices in sugarcane crop shows that before

**Table 4: Adoption of mechanical methods by the farmers**

Items	Before intervention		After intervention	
	Frequency n <sub>1</sub> = 110	Per cent	Frequency N=112	Per cent
<b>Tools used for mechanical method</b>				
Bakhar	81	73.64	12	10.72
Spade	28	25.45	1	0.89
Khurpi	1	0.91	-	-
Tractor drawn implement	-	-	99	88.39
Mechanical method not adopted	-	-	-	-
<b>Total</b>	<b>110</b>	<b>100.00</b>	<b>112</b>	<b>100.00</b>
<b>Number of mechanical weeding done by the farmers</b>				
5 times	12	10.90	5	4.46
3 times	98	89.10	62	55.36
2 times	-	-	45	40.18
Mechanical method not adopted	-	-	-	-
<b>Total</b>	<b>110</b>	<b>100.00</b>	<b>112</b>	<b>100.00</b>
<b>Time of mechanical weeding (DAS)</b>				
30	35	31.82	12	10.71
45	75	68.18	13	11.61
60	-	-	81	72.32
90	-	-	6	5.36
Mechanical method not adopted	-	-	-	-
<b>Total</b>	<b>110</b>	<b>100.00</b>	<b>120</b>	<b>100.00</b>
<b>Time required for one mechanical weeding</b>				
2.5 hour	-	-	99	88.39
2 and half day	18	16.37	12	10.72
3 day	63	57.27	1	0.89
4 day	29	26.36	-	-
Mechanical method not adopted	-	-	-	-
<b>Total</b>	<b>110</b>	<b>100.00</b>	<b>112</b>	<b>100.00</b>
<b>Labour required for one mechanical weeding</b>				
1 labour	81	73.64	111	99.11
3 labour	5	4.55	-	-
10 labour	16	14.54	1	0.89
15 labour	8	7.27	-	-
Mechanical method not adopted	-	-	-	-
<b>Total</b>	<b>110</b>	<b>100.00</b>	<b>112</b>	<b>100.00</b>

**Table 5: Adoption of herbicide application practices by the sugarcane farmers**

Use of different herbicide in Sugarcane	Before intervention		After intervention		
	Frequency	Per cent	Frequency	Overall per	Per cent over
24-D	-	-	88	78.58	88.00
24-D + Metribuzin	-	-	12	10.71	12.00
Herbicide not applied	110	100.00	12	10.71	
Total	110	100.00	112	100.00	100.00
<b>Dose of herbicide</b>					
600ml	-	-	3	2.68	3.00
750ml	-	-	1	0.89	1.00
1000ml	-	-	85	75.89	85.00
1250ml	-	-	11	9.83	11.00
Herbicide not applied	110	100.00	12	10.71	
Total	110	100.00	112	100.00	100.00
<b>Quantity of water used in one spray</b>					
300l	-	-	76	67.86	76.00
400l	-	-	8	7.15	8.00
450l	-	-	4	3.57	4.00
500l	-	-	12	10.71	12.00
Herbicide not applied	110	100.00	12	10.71	
Total	110	100.00	112	100.00	100.00
<b>Time of herbicide spray (DAS)</b>					
20	-	-	12	10.71	12.00
25	-	-	9	8.04	9.00
30	-	-	59	52.68	59.00
45	-	-	20	17.86	20.00
Herbicide not applied	110	100.00	12	10.71	
Total	110	100.00	112	100.00	100.00
<b>Method of herbicide application</b>					
POE	-	-	79	70.54	79.00
PRE	-	-	21	18.75	21.00
Herbicide not applied	110	100.00	12	10.71	
Total	110	100.00	112	100.00	100.00
<b>Time of herbicide application</b>					
Morning	-	-	100	89.29	100.00
Herbicide not applied	110	100.00	12	10.71	
Total	110	100.00	112	100.00	100.00
<b>No. of spray</b>					
One spray	-	-	93	83.04	93.00
Two spray	-	-	7	6.25	7.00
Herbicide not applied	110	100.00	12	10.71	
Total	110	100.00	112	100.00	100.00
<b>No. of labour required in one spray</b>					
1	-	-	35	31.26	35.00
2	-	-	58	51.78	58.00
4	-	-	2	1.79	2.00
5	-	-	2	1.79	2.00
6	-	-	3	2.67	3.00
Herbicide not applied	110	100.00	12	10.71	
Total	110	100.00	112	100.00	100.00

*Common name: 2, 4-D*

*Trade name: weedmar @1.0Kg/ha POE 35-40 DAS*

*Common name: Metribuzin*

*Trade name: Sencor @1.0-1.5kg/ha PRE 1-2 DAT*

intervention none of the farmer applied herbicide to control weeds. Whereas after intervention of weed management practices majority of farmers adopted chemical control method. Out of total adopters 88.00 per cent used 24-D to control weeds and few farmers (12.00 per cent) applied 24-D as well as Metribuzin in sugarcane crop. The results about doses of herbicide clears that majority of farmers 85.00 per cent applied herbicide @1000ml/ha. While considering the quantity of water for one spray of herbicide 76.00 per cent farmers used 350L water per hectare followed by 12.00 per cent used 500L water per hectare, 8 per cent farmers used 400L water/ha and 4.00per cent have used 450L water/ha. Most of the farmers 59.00 per cent spray herbicide in 30 DAS. In selected villages 79.00 per cent adopters farmers spray herbicide as post emergence and 21 per cent farmers spray herbicide as pre emergence. Cent per cent adopter farmers spray herbicide in morning time whereas majority of farmers (93 per cent) spray herbicide one time. It is also observed that higher percentage of the adopter's farmers (58.00 per cent) required 2 labour to spray herbicide.

#### **CONCLUSIONS**

Integrated weed management practices is a

sustainable tool to reduce yield losses and maintain soil health. It was found that before and after intervention of weed management practices farmers adopted mechanical control method whereas chemical control method was adopted by the farmers after intervention of weed management practices. It shows that farmers were adopting integrated weed management practices to control weeds in sugarcane. It is an effective tool of economic management of weeds and herbicides resistance.

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## **Policies and Strategies for Livestock Development in India**

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### **ABSTRACT**

*The animal husbandry plays an important role in the national economy and in the socio-economic development of the country. Higher growth rates of 8-10 per cent in animal husbandry sector help in achieving the targeted growth rate of 6 per cent for the agriculture sector as a whole. Different strategies for livestock development are facilitate genetic improvement and conservation of indigenous breeds, improve productivity of pasture lands through improved fodder seeds, improve the database in respect of livestock products and quarantine arrangements may be strengthened to avoid the outbreak of epidemics caused by invasive alien species. The policy measures should be stringent in implementing and should help in conserving the environment, culture, animal bio-diversity and sustainably in agriculture. This, in a long way helps the small farmers to obtain a sustained livelihood.*

### **Keywords**

Economic development, livestock, policy, strategies, sustainably

### **JEL Codes**

F63, H5, L1, Q56

### **INTRODUCTION**

Livestock are an important source of income and employment in rural sector. They help to meet the equity of objective of rural development through their contribution to the cash income of small and marginal farmers and landless labourers. India has made remarkable strides in the area of livestock population in the world. Animal husbandry has been an inseparable part of our human civilization and culture from the very ancient period. It is also emphasized in Vedas and Puranas that possessing livestock is a symbol and prosperity. Livestock equip people with food, income, draught power and fertilizer and act as the major livelihood means of millions of our country, where crop farming faces challenges India is one among the fastest growing economics of the world and mainly depends on the agrarian sector as a tool for progress.

Livestock wealth is more equitably distributed than that of land and the importance of livestock for the poorer households is even more. Besides, contributing food and inputs for crop production, livestock are important as savings or investments for the poor household and provide security or insurance through various ways in different policy systems (Shahi *et al.*, 2013)

More than 70 per cent of India's population lives in rural areas. Consequently there is likely to be more pressure on land as almost all the village population depends on agriculture, resulting in the very unfavorable land man ratio. Owing to the population explosion with the increasing pressure on land, agriculture alone cannot provide gainful employment to all the rural areas. Therefore allied activities like animal husbandry have to be viewed as effective instruments for supplementing the income and providing employment to the weaker sections in rural areas. Live stocks are popularly known as "live banks", are the major contributors to our national wealth and thus help in raising the living standards of rural people (Chandrashekar *et al.*, 2015).

### **OBJECTIVES**

The objectives of the present investigation were to characterize the policies for livestock development in India and to suggest livestock production strategies adopted for improving livestock development based on participatory action research.

### **METHODOLOGY**

For analysing the research paper, secondary data relating to the livestock population, value of output from livestock sector, share of agriculture & livestock, value of

**Table 1: World livestock population**

Animals	Year					
	2010	2011	2012	2013	2014	2015
Cattle	1307.6	1319.5	1336.9	1349.5	1355.9	1371.1
Buffaloes	154.3	156.8	164.3	165.5	167.4	170.7
Sheep	1121.7	1110.4	1049.5	1031.1	1025.6	1024
Goat	604.7	630.5	722.2	737.4	751.1	767.9

Source: www.faostat.com

export of livestock and livestock products, livestock animals insured etc. was been collected from government departments, organisational records and through different sources.

### World livestock population

In world the cattle population accounts 1371.1 million, buffalo's accounts 170.7 million, sheep accounted 1024 million and goat accounted 767.9 million numbers which is shown in the Table 1.

### Import and Export of livestock and their products from India

The data on Table 2 value of output from livestock sector in the year 2011 to 2014. Milk group *i.e.*, milk and milk products stand first generating. Second is the meat group which contains beef, mutton, pork, poultry meat. In 2013-14, the value of output from livestock is ₹623861 or which is 29.9 per cent of total output from agriculture and allied sectors and it contributes 6.29 of GDP as mentioned earlier in the introduction.

**Table 2: Value of output from livestock sector**  
(₹ Crores)

Item	2011-12	2012-13	2013-14
Milk Group	324895	368997	407396
Meat Group	96287	114402	132360
Eggs	16470	19352	22423
Wool & hair	512	581	569
Dung	32754	36936	41443
Increment in stock	9854	11609	12964
Value of output from livestock sector	485103	557103	623861

Source: National Accounts Statistics-2015

Table 3 shows the value of exports of livestock and livestock products during 2010-11 to 2014-15 collected from National Accounts Statistics. Leather stands first followed by meat and meat products. The export has almost doubled in 2014-15 when compared to 2010-11. It was increased to 42,255 million rupees in 2014-15.

### Expected Growth of Livestock Population and Milk Yield

It can be observed from Table 4 that the average milk yield of indigenous breeds of cattle has been around 1.98 ls as compared to crossbreds (6.75 l) and buffaloes (4.50 l). The above yield of indigenous cattle may not include the yield of draft breeds and non-descript cows

**Table 3: Share of agriculture and livestock sector in GDP**

Year	GDP (Total)	GDP (Agriculture)		GDP (Livestock sector)	
		₹ Crores	Per cent share	₹ Crore	Per cent share
2012-13	8195546	986604	12.0	324013	4.0
2013-14	9252051	1080421	11.7	367318	4.0
2014-15	10477140	1233595	11.8	406035	3.9

Source: National Accounts Statistics-2015

which are hardly milked due to low yields. Thus, except 15-20per cent of crossbreds and ele native breeds, about 80-85 per cent of the livestock, particularly the cattle are not contributing to the milk production. However, they compete for fodder and feed, resulting in huge shortage of feed resources.

### National Livestock Policy 2013

Policies are the guiding principles which are designed to influence decisions or actions in an organization. There are three types of policies

**Price policy:** These are the responsibility of national governments price policy can be categorized into

- Trade policy.
- Exchange rate policy.
- Tax and subsidy.
- direct interventions such as floor and fixed prices.

**Institutional policy:** Institutional development is needed for the provision of credit, animal health services and genetic material. The introduction of new technology must be accompanied by the strengthening of the institutional framework required for its implementation.

### Policies for promoting technological change:

Technological change may be promoted by supporting research and development and the dissemination of information to farmers. Technical research has to be completed by socio-economic research in to the institutional framework for the allocation of natural resources, credit & labour hire, the delivery of inputs and the processing and marketing of livestock products.

The main objectives of national livestock policy are:

- Livestock breed improvement and development
- Animal diseases control.

- Fodder development.
- Dairy development.

Different agencies dealing with livestock extension in India are:

- Directorate of Extension, Ministry of Agriculture
- Indian Council of Agricultural Research (ICAR)
- National Dairy Development Board (NDDB)
- Krishi Vigyana Kendras (KVKs)
- State Agricultural Universities
- State Department of Animal Husbandry (SDAH)

The allocation of funds by department of animal husbandry and fisheries is depicted in the following pie chart. More allocation was given to health services (38 per cent), followed by breeding improvement (30 per cent), extension services (10 per cent), others (9 per cent), fed and fodder development (8 per cent), technology development (3 per cent) and education (2 per cent).

#### Livestock Breeding Policies

Before 1990's the breeding policies were backed only with focus on single traits like milk, meat and eggs. High producing sheep, goat and poultry were introduced. There was no policy plans to support in-situ conservation of indigenous breeds.

After 1990's the policies dictated by projections livestock revolution. There was a push to increase to improve the single species, industrial production systems, contract arrangements, technologies that increase the

productivity. And importance was also given to conserve the local breeds.

Different schemes and projects under livestock development in India

- National Project for Cattle and Buffalo Breeding (NPCBB).
- Central Herd Registration Scheme.
- Field Performance Recording (FPR).
- Livestock Health and Disease Control Policy.
- Dairy development schemes.
- Strengthening infrastructure for quality and clean milk production.
- Integrated Sample Survey Scheme for Estimation of major Livestock Products.
- Policies for Fodder Development.

The main statutory bodies which involved in the livestock development are:

- Department of animal husbandry and dairying.
- National dairy development board.
- National dairy research institute.

#### Department of Animal Husbandry and Dairying (DAH & D)

Now it is renamed as department of animal husbandry and Fisheries from 1st February, 1991 by Ministry of Agriculture

The department is responsible for matters relating to livestock production, preservation, practices and improvement of stocks and dairy development (George, 2014).

**Table 4: Value of export of livestock and livestock products**

Broad groups	(₹Million)				
	2010-11	2011-12	2012-13	2013-14	2014-15
Livestock	47.5	58.9	76.3	90.41	62.82
Meat and edible meat products	7721.3	7964.3	14568.6	11828.4	13575.5
Dairy and poultry products	859	1142.9	2081.6	3524.8	3567
Animal fodder and feed	671.5	418	543.6	973.2	322.41
Leather	11292.7	10384.1	17455.7	21971.4	24705.4
Raw wool and animal hair	63	38.7	34.2	18.8	22.8
All groups	20965	20006.9	34760	38407.01	42255.93

Source: National Accounts Statistics-2015

**Table 5: Expected growth of livestock population and milk yield**

Type of animals	2010-11			2021-22		
	Population (Million)	Production (Mt)	Wet average (kg/day)	Population (Million)	Production (Mt)	Wet average (kg/day)
Indigenous	28.158	20.263	1.98	31.264	26.248	2.28
Crossbred	2.580	18.682	6.75	12.347	44.703	7.98
Buffalo	32.864	53.986	4.50	40.061	97.789	5.94
Goat	--	4.073	--	--	6.512	--

Source: Department of Animal Husbandry and Dairying, Ministry of Agriculture (2012)

### **National Dairy Development Board (NDDB)**

NDDB began its operations with the mission of making dairying a vehicle to a better future for millions of grass root milk producers. It was established during operation flood 1967.

### **National Dairy research Institute (NDRI)**

It is the premier organization that provides research and development support for dairy development programme of the nation. The institute provides high quality education in the field of dairying.

### **National Project for Cattle and Buffalo Breeding (NPCBB)**

1. GOI has initiated a major programme NPCBB from October 2000 over a period of ten years in two phases each of five years with an allocation of ₹402 crore in each phase.
2. It envisages the genetic upgradation and development of indigenous breeds on priority basis.

### **The objectives of this project are as follows:**

- a. Arrange delivery of vastly improved artificial insemination service at the farmer's doorstep.
- b. Bring all breed able females among cattle and buffalo under organized breeding through artificial insemination or natural service by high quality bulls within a period of 10 years.
- c. Undertake breed improvement programme for indigenous cattle and buffaloes so as to improve the genetic make-up as well as their availability.

### **Components of this project are:**

- a. Streamlining storage and supply of liquid nitrogen by sourcing supply from industrial gas manufacturers and setting up bulk transport and storage systems.
- b. Introduction of quality bulls with high genetic merit.
- c. Quality control and certification of bulls and services at sperm stations, semen banks and training institutions.
- d. Development of minimum standard protocol scheme (MSP) for production in order to produce frozen scheme of uniform quality developed in consultation with experts from BAIF, NDDB, NDRI, CFSP and TI (Hasaraghatta, Karnataka).

### **Livestock Health and Disease Control Policy**

It is a macro management and centrally sponsored scheme. It is being implemented with the following components to control diseases.

- ✓ Assistance to states for control of animal diseases (ASCAD)
- ✓ National Project on Rinderpest Eradication (NPRE)
- ✓ Professional Efficiency Development (PED)
- ✓ Foot and Mouth Disease Control Programme (FMD-CP)

### **Strategies adopted for improving livestock development, (Mishra, 2014)**

1. Expansion of infrastructure and to strengthen them.
2. Creation of seed stock of superior bulls and bull mothers
3. Adequate animal health services
4. Facilitate genetic improvement and conservation of indigenous breeds
5. Improve productivity of pasture lands through improved fodder seeds
6. Improve the database in respect of livestock products
7. Quarantine arrangements may be strengthened to avoid the outbreak of epidemics caused by invasive alien species.
8. Productivity of our dairy cattle is low, both due to genotype and poor nutritional intake NDDB has shown that rapid progress in milk production can be achieved through integrated attention to breed improvement, disease management, better nutrition and producer oriented processing and marketing.
9. In the case of poultry production, Poultry Estates may be organized with help from the Egg Coordination Council and the organized poultry industry to help SC/ST and other resource poor communities take to economically viable poultry farming.

### **Strategy Required to Boost Production (Poultry)**

- a. Quarantine measures.
- b. Include eggs in mid-day meal programme.
- c. Credit facility to poultry farmers.
- d. Encouragement of quality maize and soybean production.
- e. Induction of minimum support price.

### **National Livestock Mission**

The National Livestock Mission (NLM) has commenced from 2014-15. The Mission is designed to cover all the activities required to ensure quantitative and qualitative improvement in livestock production systems and capacity building of all stakeholders. The Mission will cover everything germane to improvement of livestock productivity and support projects and initiatives required for that purpose subject. This Mission is formulated with the objective of sustainable development of livestock sector, focusing on improving availability of quality feed and fodder. NLM is implemented in all States.

### **NLM has 4 submissions as follows:**

1. The Sub-Mission on Fodder and Feed Development will address the problems of scarcity of animal feed resources, in order to give a push to the livestock sector making it a competitive enterprise for India, and also to harness its export potential. The major objective is to reduce the deficit to nil.
2. Under Sub-Mission on Livestock Development,

there are provisions for productivity enhancement, entrepreneurship development and employment generation (bankable projects), strengthening of infrastructure of state farms with respect to modernization, automation and biosecurity, conservation of threatened breeds, minor livestock development, rural slaughter houses, fallen animals and livestock insurance.

3. Sub-Mission on Pig Development in North-Eastern Region: There has been persistent demand from the North Eastern States seeking support for all round development of piggery in the region. For the first time, under NLM a Sub-Mission on Pig Development in North-Eastern Region is provided wherein Government of India would support the State Piggery Farms, and importation of germplasm so that eventually the masses get the benefit as it is linked to livelihood and contributes in providing protein-rich food in 8 States of the NER.
4. Sub-Mission on Skill Development, Technology Transfer and Extension: The extension machinery at field level for livestock activities is very weak. As a result, farmers are not able to adopt the technologies developed by research institutions. The emergence of new technologies and practices require linkages between stakeholders and this sub-mission will enable a wider outreach to the farmers. All the States, including NER States may avail the benefits of the multiple components and the flexibility of choosing them under NLM for a sustainable livestock development.

#### Livestock Insurance Scheme

The Livestock Insurance Scheme, a centrally sponsored scheme, which was implemented on a pilot basis during 2005-06 and 2006-07 of the 10th Five Year Plan and 2007-08 of the 11th Five Year Plan in 100 selected districts. The scheme is being implemented on a regular basis from 2008-09 in 100 newly selected districts of the country. Under the scheme, the crossbred and high yielding cattle and buffaloes are being insured at maximum of their current market price. The premium of the insurance is subsidized to the tune of 50 per cent. The entire cost of the subsidy is being borne by the Central Government. The benefit of subsidy is being provided to a maximum of 2 animals per beneficiary for a policy of maximum of three years. The scheme is being implemented in all states except Goa through the State Livestock Development Boards of respective states. The scheme is proposed to be extended to 100 old districts covered during pilot period and more species of livestock including indigenous cattle, yak, and mithun.

The Livestock Insurance Scheme has been formulated with the twin objective of providing protection mechanism to the farmers and cattle rearers against any eventual loss of their animals due to death and

to demonstrate the benefit of the insurance of livestock to the people and popularize it with the ultimate goal of attaining qualitative improvement in livestock and their products.

Table 6 shows the number of animals insured over the years, it had been declined this is due to reduction in number of low value animals such as sheep and goat.

**Table 6: The number of livestock animals insured**

(₹ Crores)				
Year	No. of animals insured (Million)	Premium collected	Incurred claims amount	Claims to premium ratio
2009-10	15.3	113.39	74.05	65
2010-11	14.7	122.54	74.83	61
2011-12	6.3	143.45	80.11	56
2012-13	7.9	152.02	126.08	83
2013-14	9.8	137.14	114.28	83
2014-15	7.9	145.53	127.97	88

#### CONCLUSIONS

By discussing the policies, strategies to achieve these policies for livestock development, it can be concluded that the policy measures should be stringent in implementing and should help in conserving the environment, culture, animal bio-diversity and sustainably in agriculture. The schemes like NPCBB and Dairy/Poultry capital venture fund are commendable. The government should give importance to improve the genetic upgradation and development of indigenous breeds which is more essential at present scenario. And it also should give financial assistance to small farmers to encourage dairy farming which help in sustaining their livelihood. Programmes like Vishwa Go Sammelana will help to create awareness about importance of livestock in the society. There is an urgent need for formulating a separate, integrated national livestock policy and for implementing it with adequate institutional support and resources so that the increase in upgradation and development of indigenous breeds which is very much essential at present scenario. Livestock sector is likely to emerge as an engine for agricultural growth in the coming decades. This, in a long way helps the living standards of small farmers to obtain a better and sustained livelihood.

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## **Increasing Farm Productivity, Income and Employment through Farming System Approach: A Review of Concepts, Constraints and Issues**

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### **ABSTRACT**

*Farming is an important component of the economy of developing countries. Farming system is a viable approach, which represents an appropriate combination of farm enterprises, viz; crop production, horticulture, livestock, fishery, forestry, poultry and goat farming, etc. Farming system provides increased productivity per unit land, better utilisation of resources, recycling of farm wastes, sustainability, higher income and employment generation and reduction of risk. Hence, it is viewed as a powerful tool for natural and human resource management in developing countries like, India. This is multidisciplinary whole farm approach and very effective in solving the problems of small and marginal farmers. This approach not only increases income and employment opportunity but protect the environment through recycling of the crop and animal wastes within the farm itself. The present paper reviews the role of farming system approach in increasing income and employment, also highlights constraints in their adoption.*

### **Keywords**

Constraints, farming system approach, issues, optimum farm plans

### **JEL Codes**

A12, Q01, Q10

### **INTRODUCTION**

Indian agriculture currently faces a lot of challenges and constraints due to the ever growing population, increasing food and fodder needs, natural resource degradation and higher cost of inputs and concerns of climate change. The country's population is expected to reach 1,660 million by the year 2050 and for which 349 million tonnes of food grains will be required. It is anticipated that land area available in 2050 would be 137 million hectares. To meet this requirement there is urgent need to double the productivity of agricultural crops from the existing level (Khan *et al.*, 2015). Since there is no further scope for horizontal expansion of land for cultivation of farm enterprises, the emphasis should be on vertical expansion by increasing the productivity using the available resources properly and choosing the best enterprises. The average size of the landholding has declined to 1.16 ha during 2010-11 from 2.28 ha in 1970-71. If this trend continues, the average size of holding in India would be mere 0.68 ha in 2020 and would be further reduced to 0.32 ha in 2030. This situation in India calls

for an integrated effort to address the emerging livelihood issues. It is imperative to develop strategies and agricultural technologies that enable adequate income and employment generation, especially for small and marginal farmers who constitute more than 85 per cent of the farming community. (Dashora & Singh, 2014). Increase in non-farm employment has also become essential for improving income and living standards of rural population (Singh *et al.*, 2009).

### **FARMING SYSTEM APPROACH**

Farming system is a mix of farm enterprises in which farm families allocate resources for efficient utilization of the existing enterprises for enhancing productivity and profitability of the farms. These farm enterprises are crops, livestock, aquaculture, agro-forestry, agro-horticulture and sericulture (Varughese & Mathew, 2009). Jayanthi *et al.* (2000) describes the Integrated Farming System (IFS) as a mixed animal crop system where the animal component is often raised on agricultural waste products while the animal is used to cultivate the soil and provide manure to be used as fertilizer and fuel.

Agbonlabor *et al.* (2003) defined the IFS as a type of mixed farming system that combines crop and livestock enterprises in a supplementary or complementary manner. Radhamani *et al.* (2003) described IFS as a component of farming systems which takes into account the concepts of minimizing risk, increasing production and profits. Jayanthi *et al.* (2003) stated that IFS is a component of Farming System Research (FSR), introduces a change in the farming techniques for maximum production in the cropping pattern and takes care of optimal utilization of resources. Singh & Ratan (2009) defined the IFS as an integrated set of elements / components and activities that farmers perform in their farms under their resources and circumstances to maximize the productivity and net farm income on a sustainable basis. Panke *et al.* (2010) stated that the integration is made in such a way that the product *i.e.* output of one enterprise / component should be the input for the other enterprises with high degree of complementarity effects. Similarly the authors stated that the rationale of IFS is to minimize the wastes from the various sub systems on the farm and thus it improves employment opportunities, nutritional security and income of the rural people. Farming system approach is not only a reliable way of obtaining fairly high productivity with considerable scope for resource recycling, but also concept of ecological soundness leading to sustainable agriculture (Manjunatha *et al.*, 2014). Sasikala *et al.* (2015) defined Integrate Farming System (IFS) as a mixed farming system that consists of at least two separate but logically interdependent parts of a crop and livestock enterprises.

#### **ECONOMIC IMPORTANCE OF FARMING SYSTEM APPROACH**

Ravishankar *et al.* (2007) reported the findings of net returns obtained from all the components was ₹22,887 with an increase of 32.3 per cent higher returns than conventional rice-rice system. Ramrao *et al.* (2005) developed a crop livestock mixed farming model of 1.5 acre small scale holders with the employment generation of 571 man days, net income of ₹58,456 per year against crop farming alone with employment generation of 385 man days and net returns of ₹18,300 per year only. Ramrao *et al.* (2006) noticed that the mixed farming of 2 bullocks+ 1 cow+ 1 buffalo + 10 goats+ 10 poultry and 10 ducks gave a net return of ₹33,076 compared to ₹7,843 from arable farming. Veerabhadraiah (2007) noticed that the crop livestock integrated farmers were getting higher returns *i.e.* a farmer with 2.5 acres of irrigated land, Buffaloes were earning ₹1, 04,321 and a farmer with 3.5 acres of irrigated land with 2 cows and 4 sheep earning ₹78,867. Nageswaran *et al.* (2009) found that the annual net revenue per acre is higher for IFS as compared to conventional farming system (CFS): the average net annual revenues per acre of IFS and CFS were ₹11,662 and ₹4,553, respectively. Annual employment per acre is

turned out to be 186 person days in IFS and that of CFS 89 persons, respectively. Channabasavanna *et al.* (2009) showed the benefit- cost ratio of 1.97 in IFS than conventional system which is of 1.64. Among the various components of Palladam district of goat recorded the highest benefit- cost ratio (2.75) followed by fish (2.23), vegetables (2.00) whereas poultry showed the lowest benefit- cost ratio (1.13) as a result of high cost of maintenance. Tripathi *et al.* (2010) reported that the integration of seven different enterprises namely, crop+ fish+ goat+ vermicompost+ fruit production+ spice production+ agro forestry obtained the net return to the tune of Rs. 2,30,329 annually with the Benefit- Cost Ratio (BCR) of 1.07:1 and also reported the maximum per cent contribution of the enterprise is the fish production (68.53 per cent) followed by vermicomposting (9.90 per cent), spices (8.46 per cent) and animal production (7.40 per cent). The BCR was found to be highest for the spice production (1.83:1) after fishery (2.25:1) followed by the vermicomposting (1.45:1). The combined enterprises activity had shown its potential in raising the net farm income to steer them out of the clutches of poverty as well as in generating more employment opportunities in the Karnal district of Haryana (Deoghare *et al.*, 1991). The income and employment levels can be improved by using the farming system approach in Punjab agriculture (Toor *et al.*, 2006). Diversification through the vegetable crops has high potential for employment and income generation in Western-Himalayan region (Oberai & Raina, 1991). In Himachal Pradesh, Saini *et al.* (1996) studied the impact of diversification on small farms economy. They revealed that diversification of arable farming systems with commercial enterprises such as high-yielding milch animals, poultry birds, bee-keeping, floriculture, *etc.*, resulted in a marked increase in the farm income ranging from 6.00 to 138.00 per cent. The increase in human labour employment as a result of diversification ranged from 17.00 per cent to 51.00 per cent in optimum plans.

A study on farm income and investment pattern in northern Madhya Pradesh indicated wide variation amongst the income and investment pattern in small and large farms. The net cash income generated by small, medium and large farms varied between 40 to 50 per cent of total investment annually (Gautam & Verma, 1999). The increasing farm income through rice-fish based integrated farming system in rainfed lowlands of Assam (Rautaray *et al.*, 2004). In the case of Dharwad peri-urban area the net returns were highest in system involving crops, vegetables, dairy and poultry whereas in rural area the farming system consisting of crops, dairy, goat performed much better (Sachikumar *et al.*, 2012). Singh *et al.* (2008) reported that the major income source of farmers in the western Uttar Pradesh has been found sugarcane (58 per cent), followed by livestock and cereal crops. Singh & Joshi (2008) worked out economic analysis of crop production and dairy farming for marginal and small farmers in Punjab for the year 2003-

2004 and found that a majority of the farm household were not able to meet their requirement from their income from crops and dairy farming. Further dairy farming had emerged as a major allied enterprise for supplementing the income of marginal and small farmers in Punjab. Singh *et al.* (2008) found that sugarcane, livestock, cereals and fodder were the major system being followed by a majority of the farmers amongst thirty eight farming system prevalent in the western Uttar Pradesh region. The major income source of farmers in the area was sugarcane (58 per cent), followed by livestock and cereal crops. Toor *et al.* (2009) conducted a study in Phagwara Development Block, Kapurthala district. The results of the study indicated that all the Integrated farming systems, involving crops (rice, wheat, and aloe-vera) and livestock (dairy animals, pigs, poultry, fish, rabbits and honey bees), proved more profitable than crops alone (rice-wheat system) in terms of net returns. The role of women in this field is highly substantial. More than eighty percent of the work has to be performed by women. They are working as labourers in involved in different agricultural operations. Women have a bright future in the field of agriculture as it is the evergreen profession and involves much scope for future (Satyagopal & Vijayabhinandana, 2012)

#### **ISSUES AND CONSTRAINTS IN FARMING SYSTEM APPROACH: NEED A DAY**

Due to low agricultural productivity, the small and marginal farmers as well as about 15 to 18 per cent landless families living in the rural areas are unable to generate remunerative employment and about 40 per cent families are forced to live in poverty. With lack of food and income security, trans-migration wherein the poor families are compelled to migrate to cities in distress, keeping their agricultural lands fallow, may become a major national challenge. Farming System Research (FSR) offers the potential scope to solve the technology development problems. Research organizations in many countries are shifting towards farming system approach with heavy emphasis on participatory on-farm research (PDFSR, 2013). It is also a fact that highly productive lands have been diverted from agriculture to infrastructural development, urbanization and other related activities. Ganesh (2000) classified the problems faced by the farmers in Integrated Farming System under four groups' viz; production, financial, infrastructural and marketing problems in Gazani lands of Karnataka. The important problem was absence of market regulation and information. Vyas & Patel (2001) studied constraints faced by milk producers in adoption of dairy technology revealed that non availability of loan facilities for purchase of milch animals and fodder, non-availability of artificial insemination and milk marketing facilities, lack of knowledge of scientific animal feeding as well as preservation practices and no pasture land were the main constraints in adoption of dairy industry. Chandrashekar *et al.* (2000) listed production constraints faced by

growers in Integrated Farming System in the order of importance. They were lacking in technical guidance, more pests and diseases, high cost of fertilizers, high cost of plant protection chemicals, non-availability of seed materials and non-availability of fertilizer in time. Kumar & Singh (2002) studied problems in vegetable production. The problems reported in Integrated Farming System were, poor quality seeds (42.2 per cent), insufficient availability of seed (40 per cent), high cost of seed (31 per cent) and non-availability of seed at appropriate time (12.2 per cent). The other problems noticed were high cost of fertilizer, poor state of fertilizer and plant protection delivery system in the district. High wages and shortage of labour was also one of the constraints. Kulkarni & Kunnal (2002) identified the constraints in production, marketing and processing of soybean in Belgaum district. The severe problems faced by growers in Integrated Farming System was rust disease leading to heavy loss, high labour wages and non-availability of quality seeds in the production front. In marketing, farmers experience problem of price fluctuation, low price for the produce, problem of transportation and delayed payment of sale when produce was sold out to co-operative society. The other problems were inadequate power supply and non-availability of labour at times faced by the processor. Wadear (2003) pointed out the problems faced by the sample farmers in production of different crops in selected zones of northern Karnataka. It was observed that problems like price fluctuation, lack of storage facility and incidence of pests and diseases were reported as severe problems under Farming System-I (green gram, jowar, tur, black gram, paddy, sunflower, and groundnut) in *kharif* season. Under these circumstances the only option is to increase the productivity vertically. Farming systems are faced with complex, dynamic and interrelated changes in the production context related to climate change, increasing food demand, scarcity of natural resources, volatile input and output prices, rising energy costs and administrative regulations (Thompson and Scoones, 2009).

#### **OPTIMUM FARM PLANS FOLLOWED BY DIFFERENT FARMING SYSTEMS**

Goswamy (1997) attempted to develop optimum farm plans for the Garo hill areas where shifting cultivation was practiced for augmenting the incomes of the hill farmers by eliminating shifting cultivation. He used linear programming model to maximize farm business income under the prevailing level of resources, with capital borrowing and simultaneous hiring of capital and human labour. He indicated that the systematic farm planning was a paying proposition under the existing technology and with the existing resource base on the hill farms. Naik (2003) conducted a linear programming study by including different livestock enterprises with chili based crop activity and developed optimum plans under existing and improved technology levels. The author concluded that the return per farm over the existing plan

was highest for large farmers of Farming System- I (crop production + dairy enterprise) as compared to Farming System-II (crop production + poultry) and Farming System-III (crop production + sheep enterprises).

## CONCLUSIONS

The profitability of farming systems is well known to the world and can be considered for its wide spread adoption by small and marginal farmers. Declining size of landholdings without any alternative income augmenting opportunity is gradually reducing the farm income, and causing agrarian distress. A large number of smallholders have to move for non-farm activities to augment their income. Under the changing scenario, a paradigm shift in research is inevitable with more focus towards small and marginal holders in farming systems perspective. Potential improvements and increased productivity from the various enterprises can only come from a better understanding of the nature and extent of the interactions among various enterprises and natural resources, economic benefits, as well as the impact on the livelihoods of small farmers and the environment. Research on these aspects will provide major challenges for sustainable agricultural development through integrated farming systems in the future.

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## Adaptation and Climate Change: Challenges for Doubling the Farmers Income

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### ABSTRACT

Indian agriculture faces high degree of sensitivity to climate change, which is compounded in areas of extreme poverty and high dependency on agriculture. 58% of our population is dependent on agriculture and 85% of the total farmers are small and marginal farmers. Climate change is already making adversely impact on farmer's income. It is already evident in a number of ways. Consistent warming trends and more frequent and intense extreme weather events such as droughts, cyclones, floods, and hailstorms have been observed across the study. The study shows that use of technologies like change in varieties, change in irrigation system, use of drought tolerant varieties, mulching and mixed farming practices, use of bio fertilizers and pesticides, watershed management, change in land use and new farm management practices and agriculture insurance etc can be double the farmers income in changing climatic conditions. Climate change can have a direct or indirect effect on the price of agricultural imports. The projected impacts are likely to further magnify decline in productivity of many crops with impact on food security. Global food prices will rise due to imbalance of food production and balance of trade. This requires a serious attention on adaptation and mitigation strategies to overcome the problems of climate change for doubling the farmers' income by 2022.

### Keywords

Adaptation, climate change, food security, mitigation

### JEL Codes

E64, F17, Q54 Q17, Q18

### INTRODUCTION

The atmosphere surrounding the earth is made up of nitrogen (78 per cent), oxygen (21 per cent) and the remaining 1 per cent, is made up of trace gases (called so because they are present in very small quantities) that include carbon dioxide, methane and nitrous oxide. These gases also called greenhouse gases act as a blanket and trap heat radiating from the earth and make the atmosphere warm. Beginning with the industrial revolution global atmospheric concentrations of these greenhouse gases have increased markedly as a result of human activities. The global increases in carbon dioxide concentration are due primarily to fossil fuel use and land use change, while those of methane and nitrous oxide are primarily due to agriculture. As a result we are witnessing global warming. The increasing greenhouse gases (GHG) resulted in global warming by 0.74°C over

past 100 years and 11 of the 12 warmest years were recorded during 1995-2006. The Intergovernmental Panel for Climate Change (IPCC) projections on temperature predicts an increase of 1.8 to 4.0°C, by the end of this century. Some changes will affect agriculture through their direct and indirect effects on crops, soils, livestock, fisheries and pests. The brunt of environmental changes is expected to be very high in India due to greater dependence on agriculture, limited natural resources, alarming increase in human and livestock population, changing pattern in land use and socio-economic factors that pose a great threat in meeting the food, fibre, fuel and fodder requirement.

### Climate change, agriculture and trade-review of the literature

Climate change refers to a change in the state of the climate that can be identified by changes that persists for

an extended period, usually decades or longer (IPCC, 2007). Climatic changes and increasing climatic variability are likely to aggravate the problem of future food security by exerting pressure on agriculture. Climate alteration i.e. increase in global mean temperature and vents of inconsistent rainfall affect crop production through direct impacts on the biophysical factors such as plant and animal growth and the physical infrastructure associated with food processing and distribution to rising sea levels and accelerate corrosion of coastal zones, increasing intensity of instinctive catastrophe, species annihilation and spread of vector borne ailments. Sinha & Swaminathan (1991) stated that 2°C increments in mean air temperature results in dwindling rice acquiesce by about 0.75 ton/hectare in the high yield areas and by about 0.06ton/hectare in low yield coastal region. Further a 0.5°C increase in winter temperature would reduce wheat crop interval by 7 days and thus reduce yield by 0.45 ton/hectare. It has been reported that the effect of climate variation on wheat yield in North India and found that 1°C rise in mean temperature would have no momentous effects on yield while 2°C increase would reduce yields. Rao and Sinha (1994) reported the impact of climate change on wheat yield and found that the wheat yield reduced by 28-68 per cent. Darwin *et al.* (1995) assessed the impact of climate change and found 20-30 per cent reduction in grain production. Fischer and Velthuisen (1996) investigated the influence of climate variation and reported that elevated temperature would have affirmative impact in higher land area. Mearn *et al.* (1999) evaluated the impacts of climate change on corn and wheat yield in the Central Great Plain using 2 crop models (CERES and EPIC) and found considerable discrepancy between crop models. Mendlesohn and Dinar (1999) also assessed the impact of climatic variation on agriculture by using three different methods viz. Ricardian, agro economic model and agro ecological zone analysis. The result concluded by these models showed that increase in temperature will lower crop production especially for the crops grown in cool areas. Murdiyasso (2000) estimated the probable influence of climate change and inconsistency on rice production in Asia, led to 7.4 per cent of rice potential per degree increase in temperature. Likewise, Tubiello *et al.* (2000) testified combined effects of increased CO<sub>2</sub> concentration and climate change and found reduction in crop yields by 10- 40 per cent. Saseendran *et al.* (2000) found that increment in temperature up to 50°C can lead to continuous decline in the yield of rice and every one degree increment of temperature will lead up to 6 per cent decline in yield in Kerala. Rathore *et al.* (2001) reported the impact of climate change on rice production in India by using CERES rice model and concluded that by the middle of 21st century, an increase in rice yield is expected in Central and South India. Uprety *et al.* (2003) reported increase in rice grain yield due to elevated CO<sub>2</sub> concentration. The increased net photosynthetic rate and

larger accretion of sugar contributed significantly to the accelerated development of leaves, tillers and finally grain yield. Pathak *et al.* (2003) reported disapproving inclination of increasing solar radiation on potential yields of rice and wheat in Indo- Gangetic Plains of India. Attri and Rathore (2003) found increase in wheat yield between 29–37 per cent and 16–28 per cent under rainfed and irrigated conditions especially in different genotypes under a modified climate. An increase in temperature by 30°C or more shall cancel out the positive effects of CO<sub>2</sub>. Mall *et al.* (2004) used the CROPGRO-soybean model to simulate the impact of climate change on soybean production in India. Hundal and Kaur (2007) found that an increase in minimum temperature up to 1.0 to 3.0 degrees Celsius above normal has led to decline in productivity of rice and wheat by 3 per cent and 10 per cent respectively in Punjab. Kaul & Ram (2009) found that excessive rains and extreme variation in temperature has adversely affected the productivity of Jowar crop, thereby this has affected the incomes of farmers. Geethalakshmi *et al.* (2011) reported that productivity of rice crop has declined by 41 per cent with 40°C increase in temperature in Tamil Nadu. Srivastava *et al.* (2010) concluded that climate change will reduce monsoon sorghum productivity up to 14 per cent in central zone and up to 2 per cent in south central zone by 2020 in India. Similar studies testified by Teixeira *et al.* (2012) reported that increase in temperature increases the probability of heat stress throughout decisive reproductive phase which causes sterility, reduced yield and chance of inclusive crop malfunction. Impact of climate change on winter wheat and maize using the info crop model was studied by Haris *et al.* (2013). It was found that under changed climate, wheat yield decreased whereas the yield of winter maize increased due to warmer winters and enhanced CO<sub>2</sub> compared to baseline. In addition to this, duration of both crops was found to decrease owing to higher temperature.

#### **Agricultural trade and climate change linkages**

Trade plays an important role in maintaining equilibrium on food availability during periods of variable climatic conditions as more food is imported by countries that experience shortfalls in crop production due to insufficient rains as was the case in South Asia in the late 1980s. Also, trade will play an important role in enabling countries moderate the impacts of climate change on crop by enabling farmers in regions less adversely affected to sell their produce in areas more severely affected by climate change.

Climate change can have a direct or indirect effect on the price of agricultural imports. Climate models have shown that increased production from the areas that will 'benefit' from climate change will be smaller than the decline in those that will 'lose' global supply. This will most likely lead to a rise in agricultural prices. This direct impact is additional to the other influences on global demand and supply (such as rising incomes, increased

population and hence demand and increased drive for production of biofuels).

Some climate change mitigation strategies will have implications for agricultural prices. In an effort to reduce consumption of fossil fuels and hence cut greenhouse gas emissions, there is a significant global increase in the production of biofuels. This has contributed to the current food crisis by raising agricultural prices by diverting agricultural resources away from food production.

Many developing countries generate a large part of the foreign exchange required to fund imports through the export of agricultural goods. The net impact of climate change will result from a combination of the impact on their production of exported crops and demand for these in the world. Policies to reduce food miles could raise the price of vegetables and flowers in import countries while causing a glut in export countries, thereby reducing the ability of many developing countries to earn foreign exchange to participate in the international market.

Climate change can directly affect trade-related infrastructure, or trading routes. For instance, rising sea levels may endanger coastal infrastructure that supports trade, such as ports. In addition, extreme weather events can be expected to disrupt markets and infrastructure. The projected climate change projection and effect on international trade is given in Table 1 to 2.

**Table 1: Climate change projection for India**

Year	Season	Temperature change (°C)		Rainfall change (per cent)	
		Lowest	Highest	Lowest	Highest
2020s	Annual	1.00	1.41	2.16	5.97
	Rabi	1.08	1.54	-1.95	4.36
	Kharif	0.87	1.17	1.81	5.10
2050s	Annual	2.23	2.87	5.36	9.34
	Rabi	2.54	3.18	-9.22	3.82
	Kharif	1.81	2.37	7.18	10.52
2080s	Annual	3.53	5.55	7.48	9.90
	Rabi	4.14	6.31	-24.83	-4.50
	Kharif	2.91	4.62	10.10	15.18

Source: Lal et al., 2001

### Implications for Sustainable Development of farmer's income

For a long time, climate change has been viewed largely as an environmental issue of little relevance to development. For the same reason, development approaches have not been given the necessary attention by the climate change community who instead focused on reducing greenhouse gas emissions. This state of affairs is partly to blame for the heavy price countries continue to pay whenever climate disasters strike and resources diverted to attend to such events instead of having long-term strategies that may not only minimize the impacts but also ensure resources meant for development are not diverted to deal with such emergencies.

Climate change has can potentially undermine whatever modest gains have been achieved towards meeting the MDGs. It is therefore important that climate change be mainstreamed into developmental policies and plans. While climate change will likely affect development at various levels, the development approach chosen will also influence future emission of greenhouse gases as well as the adaptive capacity of individuals, communities and countries. According to Huq *et al.* (2006), unsustainable development is the underlying cause of climate change and development path taken determines the degree to which society is vulnerable to climate change.

Poverty is a strong impediment to achieving sustainable development and agriculture holds the key to reducing poverty in many developing countries. The large share of agriculture in GDP in low-income countries suggests that strong growth in agriculture is necessary for overall economic growth. As GDP per capita rises, agriculture's share in GDP declines, and so does its contribution to growth. Unfortunately, agriculture appears to be the most vulnerable sector to the adverse impacts of climate change. To achieve sustainable development, efforts need to be stepped up to mitigate and adapt. Both strategies are very important and should be pursued concurrently. The developed countries need to actively pursue strategies to reduce greenhouse gas emissions. Even if greenhouse gas were stabilized in the atmosphere today, global warming would continue for a long time. Climate change requires a global framework for international cooperation. Adaptation action is a vital part of this framework. Actions to enable adaptation to climate change pose opportunities to promote sustainable development. Developing countries require resources in order to promote these actions. A successful framework must directly involve assistance for adaptation in developing countries, particularly small island developing States and least developed countries, given that they will disproportionately bear the brunt of climate change impacts. Combating climate change is vital to the pursuit of sustainable development; equally, the pursuit of sustainable development is integral to lasting climate-change mitigation (Table 3).

**Climate Change and Sustainable Agriculture:** New and innovative adaptation measures to climate change include: (i) changes in agricultural practices to improve soil fertility and enhance carbon sequestration; (ii) changes in agricultural water management for more efficient water use; (iii) agricultural diversification towards enhanced climate resilience; (iv) agricultural science and technology development, agricultural advisory services, and information systems; and (v) risk management and crop insurance. Innovative policies include: (i) changing investment allocation within and across sectors, (ii) increasing the focus on risk-sharing and risk-reducing investments, (iii) improving spatial targeting of investments, (iv) eliminating existing

detrimental policies that will exacerbate climate change impacts, and (v) reducing greenhouse gas (GHG) emissions from agriculture and increasing the value of sustainable farming practices through the valuation of carbon and other forms of agricultural ecosystem services such as water purification and biodiversity. Climate change resilience can be built in through: 1. Stabilization

and management of the natural resource base with an ecosystems-based approach to Participatory Watershed Management as a central point of activity, 2. Assessing vulnerability of a cluster of villages/sub-region to climate change, and 3. Integrating a package of climate-smart agriculture practices into ongoing programmes such as weather-based locale specific agro- advisories, contingent

**Table 2: International trade of maize, rice and wheat**

Commodity & category	2010	2050 per cent	2010	2050 per cent	2010	2050 per cent
	(mmt)	change	(mmt)	change	(mmt)	change
	Baseline		Pessimistic		Optimistic	
<b>Developed</b>						
1. Maize						
Perfect mitigation	36.7	120.5	37.5	127.1	37.2	105.8
Climate change mean	27.8	-25.4	27.7	-36.6	27.4	-56.9
2. Rice						
Perfect mitigation	-2.6	-20.5	-2.7	-61.8	-2.6	-13.7
Climate change mean	-3.0	-12.0	-3.1	-40.5	-3.0	-3.8
3. Wheat						
Perfect mitigation	44.6	-48.8	44.1	-37.2	44.5	-39.5
Climate change mean	42.7	-66.8	41.8	-61.8	42.2	-63.9
<b>Middle-income developing</b>						
1. Maize						
Perfect mitigation	-33.8	81.5	-33.8	83.0	-34.1	62.2
Climate change mean	-26.1	-59.4	-25.4	-80.6	-25.7	-98.0
2. Rice						
Perfect mitigation	-7.0	-65.7	-6.8	25.1	-7.0	-171.7
Climate change mean	-7.5	8.2	-7.3	82.2	-7.4	-94.9
3. Wheat						
Perfect mitigation	-38.7	-111.4	-38.1	-87.0	-37.2	-148.4
Climate change mean	-37.6	-121.5	-36.8	-104.2	-35.8	-161.7
<b>Low- income developing</b>						
1. Maize						
Perfect mitigation	-2.9	571.1	0.6	571.1	-3.1	586.3
Climate change mean	-1.7	506.0	0.5	506.0	-1.7	555.9
2. Rice						
Perfect mitigation	9.6	-53.4	-0.1	-53.4	9.6	-128.5
Climate change mean	10.4	2.5	0.0	2.5	10.4	-68.5
3. Wheat						
Perfect mitigation	-5.9	363.5	0.4	363.5	-7.3	516.3
Climate change mean	-5.1	337.8	0.3	337.8	-6.4	482.4

Source: IFPRI, 2010

**Table 3: Climate change and crop productivity in India**

Crop	T opt, °C	T max, °C	Yield at T opt, t/ha	Yield at 28°C, t/ha	Yield at 32°C, t/ha	Per cent decrease (28 to 32°C)
Rice	25	36	7.55	6.31	2.93	54
Soybean	28	39	3.41	3.41	3.06	10
Dry bean	22	32	2.87	1.39	0.00	100
Peanut	25	40	3.38	3.22	2.58	20
Grain sorghum	26	35	12.24	11.75	6.95	41

Source: Singh, 2012

crop planning, promotion of low-external input technology, water budgeting, livelihood diversification, and promotion of local agro-biodiversity.

## CONCLUSION

It can be concluded that the inclusive impact of climate change i.e. variation in atmospheric structure and global ambience in terms of elevated level of CO<sub>2</sub> and other gases brings about hidden hunger crisis among individuals by decreasing indispensable nutrient content in food crops. For doubling the farmer's income by 2022, there is a need to change agriculture policies and diversification of farming to mitigate effect of climate change. Properly managing agricultural practices could contribute substantially to climate change mitigation. Efforts are increasing to get developing countries to adapt to the adverse impacts of climate change. There are however, limits to adaptation. The potential for adaptation should not lead to complacency. Agricultural adaptation to climatic variation is not perfect, and changes in how farmers operate or in what they produce may cause significant disruption for people in rural regions. Indeed, some adaptive measures may have detrimental impacts of their own. While trade liberalization holds a lot of promise for agricultural development. A completely liberalized market will not bring the same benefits to all countries. It may cause difficulties for some developing countries, in particular those dependent upon food imports or those losing preferential access to markets. Measures will be needed to help these countries to adjust. Nevertheless, in the long term, liberalization should result in a more favourable international structure of agricultural prices, which should benefit most poor countries. The most pressing challenge is to address the environmental and economic challenges of the poorest nations to reap the benefits of agricultural production in the bid to achieving sustainable development and achieving the agriculture GDPs.

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## Adoption of Integrated Farming System-An Approach for Doubling Small and Marginal Farmers Income

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### ABSTRACT

The adoption of integrated farming system instead of any individual crop or livestock enterprising will not only sustain the livelihood but also provides food security especially at small and marginal scale of farming. It is therefore important to realize that in addition to cultivation there are other income sources like allied agriculture, livestock enterprises as means of wage earning that can contribute to doubling of income of agricultural households. The economic analysis of different integrated farming systems adopted by small and marginal farmers in Adilabad district of Telangana state revealed Paddy+ Sericulture+ Poultry, Paddy-Paddy + Tomato + Goat + Poultry, Paddy + Dairy + Moriculture and Paddy-Paddy + Tomato + Cotton + Goat + Poultry as maximum returning systems. The return per rupee spent on these systems was found to be 1.89, 1.78, 1.72 and 1.70, respectively. However, lack of training facilities, high market price fluctuations, lack of credit facilities and high input costs were found to be the major constraints in adoption of farming systems by small and marginal farmers.

### Keywords

Integrated farming system, marginal farmer, return, small farmer

### JEL Codes

O13, Q00, Q16, Q18

### INTRODUCTION

An Integrated Farming System (IFS) is one which focuses on judicious combinations of any two or more of agriculture enterprises and effective recycling of residue waste for better management of available resources with small and marginal farmers to generate more income and employment for family labourers during off seasons. These enterprises not only supplement the income of the farmers but also help in providing employment to the family members throughout the year (Behera *et al.*, 2001). Indian agriculture currently faces a host of diverse challenges due to the ever growing population, increasing food and fodder needs, natural resources degradation, higher cost of inputs and concerns of climate change. A phenomenal increase in food grain production upto 253.16 mt. in the year 2015-16 could be achieved using improved technology including integrated farming systems. The country's population is expected to reach 1660 million by the year 2050 and for which 349 million tonnes of food grains will be required. It is anticipated that land area available in 2050 would be 137 million hectares.

The Economic Survey 2016-17 revealed that average income of a farmer in ₹1,670 per month which can be doubled but does that mean the farmer will get remunerative price for farming. We need to understand in an agricultural household crop cultivation on an average provides 63% income and remaining comes from other sources. It is also important to recognize that sizeable proportion of small and marginal agriculture households who undertake cultivation, livestock activities and also have individual family members who are wage earners. It is therefore important to realize that in addition to cultivation there are other income sources like allied agriculture, means of wage earning that can contribute to doubling of income of agricultural households.

### METHODOLOGY

The Adilabad district was purposively selected for the present study since large scale adoption of agricultural crops along with livestock and sericulture enterprises were present. The required primary data was obtained from a sample of 120 farmers covering five mandals purposively by adopting random sampling technique.

Economics and profitability of predominant integrated farming systems in small and marginal farms have been analyzed component wise and the pattern of gross returns, total costs and returns per rupee spent on farming systems were presented separately for small and marginal farmers. The various constraints faced by small and marginal farmers were calculated using simple percentages.

## RESULTS AND DISCUSSION

### Component wise per farm cost and returns of predominant farming systems adopted by small farms

Out of total 13 farming systems adopted by sample small farmers only six farming systems were identified as predominant based on the percentage of adoption and the economics for the same were worked out using simple budgeting technique. The economics and profitability of the six major farming systems adopted by small farms along with their component wise acreage / number were presented in Table 1.

In Farming System-I (Paddy + Dairy + Moriculture) of small farms, the gross return was highest for dairy ₹38825 followed by moriculture ₹38725 and paddy ₹35840. The component wise total cost was ₹24717.6, ₹24060 and ₹22177.3 for moriculture, paddy and dairy respectively. The net returns were of ₹16647.7, ₹14007.4 and ₹11780 respectively from dairy, moriculture and paddy. The return per rupee spent was highest for dairy (1.75) followed by moriculture (1.56) and paddy (1.48). The return per rupee spent for the total system was 1.59. These results were in conformity with the results reported by Ahmed (2006) that the dairy as a component of farming system recorded highest net returns in Mandya.

In Farming System-II (Paddy + Sericulture + Poultry) the component wise total cost was ₹43329.4, ₹26764 and ₹8104.4 from sericulture, paddy and poultry. The gross returns were highest for sericulture ₹98556.2, followed by paddy ₹39396 and poultry ₹9574. The net returns were of ₹55226.8, ₹12632 and ₹1469.6 respectively from sericulture, paddy and poultry. The return per rupee spent was highest for sericulture (2.27) followed by paddy (1.47) and poultry (1.18). The return per rupee spent for the total system was 1.88.

In Farming System-III (Paddy-Paddy-Tomato + Goat + Poultry) the gross return was highest for tomato ₹120300, followed by *kharif* paddy ₹98400, *rabi* paddy ₹85158.3, goat ₹24083.3, and poultry ₹10958.3. The component wise total cost was ₹61336.4, ₹59241.8, ₹52300, ₹12325.7 and ₹4916.3 for tomato, *rabi* paddy, *kharif* paddy, goat and poultry respectively. The net returns were of ₹58963.6, ₹46100, ₹25916.5, ₹11757.6 and ₹6042 respectively from tomato, *kharif* paddy, *rabi* paddy, goat and poultry. The return per rupee spent was highest for poultry (2.22) followed by tomato (1.96) and goat (1.95). The return per rupee spent for the total system was 1.78.

In Farming System-IV (Paddy-Paddy-Tomato +

Cotton + Goat + Poultry) the component wise total cost was ₹47107.2, ₹45576.8, ₹41828.4, ₹41725.6, ₹12948.3 and ₹4442.1 for tomato, *rabi* paddy, *kharif* paddy, cotton, goat and poultry respectively. The gross return was highest for tomato ₹100500, followed by *kharif* paddy ₹75825, *rabi* paddy ₹66975, cotton ₹53200, goat ₹23250 and poultry ₹8591.6. The net returns were of ₹53392.8, ₹33996.5, ₹21398.2, ₹11474.4, ₹10301.7 and ₹4149.5 respectively from tomato, *kharif* paddy, *rabi* paddy, cotton, goat and poultry. The return per rupee spent was highest for tomato (2.13) followed by poultry (1.93) and *kharif* paddy (1.81). The return per rupee spent for the total system was 1.70.

In Farming System-V (Paddy-Paddy-Brinjal + Dairy + Goat) the gross return was highest for brinjal ₹145650, followed by *kharif* paddy ₹102420, *rabi* paddy ₹89302.5, dairy ₹21300, and goat ₹9260. The component wise total cost was ₹67831.3, ₹67238.7, ₹59101.2, ₹19285.8 and ₹8120.3 for brinjal, *rabi* paddy, *kharif* paddy, dairy and goat respectively. The net returns were of ₹77818.7, ₹43318.8, ₹22063.8, ₹2014.2 and ₹1139.7 respectively from brinjal, *kharif* paddy, *rabi* paddy, dairy and goat. The return per rupee spent was highest for brinjal (2.15) followed by *kharif* paddy (1.73) and *rabi* paddy (1.33). The return per rupee spent for the total system was 1.70. These results are in conformity with the results reported by Saikumar (2005) that the vegetable component in the farming system under tank command area was highly profitable.

In Farming System-VI (Paddy-Paddy-Okra + Cotton + Dairy + Poultry) the component wise total cost was ₹47728.3, ₹47658.7, ₹43860.3, ₹39118.3, ₹11312.5 and ₹2228 for *rabi* paddy, okra, *kharif* paddy, cotton, dairy and poultry respectively. The gross return was highest for okra ₹83400, followed by *kharif* paddy ₹83000, *rabi* paddy ₹71852, cotton ₹48720, dairy ₹18900 and poultry ₹6190. The net returns were of ₹39139.6, ₹35741.4, ₹24123.7, ₹9601.7, ₹7587.5 and ₹3962 respectively from *kharif* paddy, okra, *rabi* paddy, cotton, dairy and poultry. The return per rupee spent was highest for poultry (2.77) followed by paddy (1.89) and okra (1.75). The return per rupee spent for the total system was 1.63.

### Component wise per farm cost and returns of predominant farming systems adopted by marginal farms

About 17 farming systems were identified on marginal farms, among which five major farming systems based on high percent of adoption by marginal farmers were considered as predominant ones. The economics and profitability of those major five farming systems along with individual components and their acreage/number were presented in Table 2.

In Farming System-I (Paddy + Dairy + Moriculture) the gross return was highest for moriculture ₹23043.7, followed by dairy ₹22175 and paddy ₹16380.4. The component wise total cost was ₹13920.7, ₹11114.8

**Table 1 Component wise per farm cost and returns of predominant farming systems adopted by small farms**

Component	Area (ha) /no.	Total cost (₹)	Gross return (₹)	Net return (₹)	Returns per ₹ spent
<b>FS I- (P+D+M)</b>					
Paddy	0.36	24060.0	35840.0 (31.60)	11780.0	1.48
Dairy	9.41	22177.3	38825.0 (34.24)	16647.7	1.75
Moriculture	0.73	24717.6	38725.0 (34.15)	14007.4	1.56
<b>Total</b>		<b>70954.9</b>	<b>113390.0</b>	<b>42435.1</b>	<b>1.59</b>
<b>FS II- (P+S+Po)</b>					
Paddy	0.44	26764.0	39396.0 (26.70)	12632.0	1.47
Sericulture	1	43329.4	98556.2 (66.80)	55226.8	2.27
Poultry	7.8	8104.4	9574.0 (6.48)	1469.6	1.18
<b>Total</b>		<b>78197.8</b>	<b>147526.2</b>	<b>69328.4</b>	<b>1.88</b>
<b>FS III- (P-P-T+G+Po)</b>					
Paddy (Kharif)	0.86	52300.0	98400.0 (29.03)	46100.0	1.88
Paddy (Rabi)	0.86	59241.8	85158.3 (25.12)	25916.51	1.43
Tomato	0.86	61336.4	120300.0 (35.4)	58963.6	1.96
Goat	9.66	12325.7	24083.3 (7.10)	11757.6	1.95
Poultry	8.33	4916.3	10958.3 (3.23)	6042.0	2.22
<b>Total</b>		<b>190120.2</b>	<b>338899.9</b>	<b>148779.7</b>	<b>1.78</b>
<b>FS IV- (P-P-T+C+G+Po)</b>					
Paddy (Kharif)	0.68	41828.4	75825.0 (23.09)	33996.5	1.81
Paddy (Rabi)	0.68	45576.8	66975.0 (20.39)	21398.2	1.47
Tomato	0.68	47107.2	100500 (30.60)	53392.8	2.13
Cotton	0.53	41725.6	53200 (16.20)	11474.4	1.27
Goat	9	12948.3	23250 (7.08)	10301.7	1.80
Poultry	8.16	4442.1	8591.6 (2.61)	4149.5	1.93
<b>Total</b>		<b>193628.4</b>	<b>328341.6</b>	<b>134713.1</b>	<b>1.70</b>
<b>FS V- (P-P-B+D+G)</b>					
Paddy (Kharif)	0.98	59101.2	102420.0 (2.83)	43318.8	1.73
Paddy (Rabi)	0.98	67238.7	89302.5 (2.46)	22063.8	1.33
Brinjal	0.98	67831.3	145650.0 (4.02)	77818.7	2.15
Dairy	9.6	19285.8	21300.0 (0.58)	2014.2	1.10
Goat	10	8120.3	9260.0 (0.25)	1139.7	1.14
<b>Total</b>		<b>221577.3</b>	<b>3617932.5</b>	<b>146355.2</b>	<b>1.70</b>
<b>FS VI- (P-P-O+C+D+Po)</b>					
Paddy (Kharif)	0.72	43860.3	83000.0 (26.59)	39139.6	1.89
Paddy (Rabi)	0.72	47728.3	71852.0 (23.02)	24123.7	1.51
Okra	0.72	47658.7	83400.0 (26.72)	35741.4	1.75
Cotton	0.48	39118.3	48720.0 (15.61)	9601.7	1.24
Dairy	10	11312.5	18900.0 (6.05)	7587.5	1.67
Poultry	10	2228.0	6190.0 (1.98)	3962.0	2.77
<b>Total</b>		<b>191906.1</b>	<b>312062</b>	<b>120155.9</b>	<b>1.63</b>

Figures in parenthesis indicate the percentage to their respective total

and ₹10779.0 for moriculture, paddy and dairy respectively. The net returns were of ₹11396, ₹9122.0 and ₹5265.6 respectively from dairy, moriculture and paddy. The return per rupee spent was highest for dairy (2.05) followed by moriculture (1.65) and paddy (1.47). The return per rupee spent for the total system was 1.72.

In Farming System-II (Paddy + Sericulture + Poultry) of marginal farms, the component wise total cost was ₹17511.8, ₹9871 and ₹2845.4 for sericulture paddy and poultry. The gross return was highest for sericulture ₹36770.8, followed by paddy ₹14711 and poultry ₹5725.

The net returns were of ₹19259, ₹4840 and ₹2879.6 respectively from sericulture, paddy and poultry. The return per rupee spent was highest for sericulture (2.09) followed by poultry (2.01) and paddy (1.49). The return per rupee spent for the total system was 1.89.

In Farming System-III (Paddy-Brinjal + Cotton + Goat) the gross return was highest for cotton ₹39900, followed by brinjal ₹28800, paddy ₹20960 and goat ₹10500. The component wise total cost was ₹26766.7, ₹15382.6, ₹13188 and ₹7904.3 for cotton, brinjal, paddy and goat respectively. The net returns were of ₹13417.4,

**Table 2: Component wise per farm cost and returns of predominant farming systems adopted by marginal farms**

Component	Area (ha) / No.	Total cost (₹)	Gross return (₹)	Net return (₹)	Returns per ₹ spent
<b>FS I- (P+D+M)</b>					
Paddy	0.18	11114.8	16380.4 (21.0)	5265.6	1.47
Moriculture	0.45	13920.7	23043.7 (29.55)	9122.0	1.65
Dairy	6.3	10779.0	22175.0 (28.43)	11396.0	2.05
<b>Total</b>		<b>46486.1</b>	<b>77979.6</b>	<b>31493.5</b>	<b>1.72</b>
<b>FS II- (P+S+Po)</b>					
Paddy	0.16	9871.0	14711.0 (25.71)	4840.0	1.49
Sericulture	0.46	17511.8	36770.8 (64.27)	19259.0	2.09
Poultry	5.58	2845.4	5725.0 (10.0)	2879.6	2.01
<b>Total</b>		<b>30228.2</b>	<b>57206.8</b>	<b>26978.6</b>	<b>1.89</b>
<b>FS III- (P-B+C+G)</b>					
Paddy	0.22	13188.0	20960.0 (20.92)	7772.0	1.59
Brinjal	0.22	15382.6	28800.0 (28.75)	13417.4	1.87
Cotton	0.36	26766.7	39900.0 (39.83)	13133.3	1.49
Goat	3.4	7904.3	10500.0 (10.48)	2595.7	1.32
<b>Total</b>		<b>63241.6</b>	<b>100160.0</b>	<b>36918.4</b>	<b>1.58</b>
<b>FS IV- (P-O+C+D+Po)</b>					
Paddy	0.22	13697.7	21440.0 (14.23)	7742.3	1.57
Okra	0.22	14698.5	24150.0 (16.03)	9451.5	1.64
Cotton	0.34	26070.2	32340.0 (21.47)	6269.8	1.24
Dairy	4.6	17149.2	23500.0(15.60)	6350.8	1.37
Poultry	5	2512.1	3600.0 (2.39)	1087.9	1.43
<b>Total</b>		<b>101312.2</b>	<b>150620.0</b>	<b>49307.8</b>	<b>1.41</b>
<b>FS V- (P-T+C+G+Po)</b>					
Paddy	0.26	15782.3	24325.0 (21.90)	8542.7	1.54
Tomato	0.26	18069.2	33360.0 (30.04)	15290.8	1.85
Cotton	0.34	25623.1	40320.0 (36.31)	14696.9	1.24
Goat	3	6523.4	7860.0 (7.07)	1336.6	1.20
Poultry	5.4	2592.2	5160.0 (4.64)	2567.8	1.99
<b>Total</b>		<b>68590.2</b>	<b>111025.0</b>	<b>42434.8</b>	<b>1.62</b>

Figures in parenthesis indicate the percentage to their respective total

₹13133.3, ₹7772.0 and ₹2595.7 respectively from brinjal, cotton, paddy and goat. The return per rupee spent was highest for brinjal (1.87) followed by paddy (1.59) and cotton (1.49). The return per rupee spent for the total system was 1.58.

In Farming System-IV (Paddy-Okra + Cotton + Dairy + Poultry) the component wise total cost was ₹26070.2, ₹17149.2, ₹14698.5, ₹13697.7 and ₹2512.1 for cotton, dairy, okra, paddy and poultry respectively. The gross return was highest for cotton ₹32340, followed by okra ₹24150, dairy ₹23500, paddy ₹21440 and poultry ₹3600. The net returns were of ₹9451.5, ₹7742.3, ₹6350, ₹6269.8 and ₹1087.9 respectively from okra, paddy, dairy, cotton and poultry. The return per rupee spent was highest for okra (1.64) followed by paddy (1.57) and poultry (1.43). The return per rupee spent for the total system was 1.41. Ravishankar *et al.* (2007) in his study on integrated farming system in Calicut also observed the highest net returns from crop component followed by the dairy

component.

In Farming System-V (Paddy-Tomato + Cotton + Goat + Poultry) the gross return was highest for cotton ₹40320, followed by tomato ₹33360, paddy ₹24325, goat ₹7860, and poultry ₹5160. The component wise total cost was ₹25623.1, ₹18069.2, ₹15782.3, ₹6523.4 and ₹2592.2 for cotton, tomato, paddy, goat and poultry respectively. The net returns were of ₹15290.8, ₹14696.9, ₹8542.7, ₹1336.6 and ₹2567.8 respectively from tomato, cotton, paddy, poultry and goat. The return per rupee spent was highest for poultry (1.99) followed by tomato (1.85) and paddy (1.54). The return per rupee spent for the total system was 1.62. Chandel & Malhotra (2006) also reported highest returns per rupee spent on poultry component in farming systems adopted by different farm size groups in poor endovered region of India.

#### **Constraints in adoption of integrated farming systems**

The constraints faced in adopting different farming systems by small and marginal farms were varied. The

**Table 3: Constraints in adoption of integrated farming systems**

Constraint	Small farmers		Marginal farmers	
	Number	Per cent	Number	Per cent
High input cost	50	83.33	45	75.00
Lack of training facilities	60	100.00	60	100.00
Lack of efficient transport and marketing facilities	46	76.66	50	83.33
High market price fluctuation	56	93.33	52	86.66
Lack of credit facilities	47	78.33	53	88.33
Scarcity of owned fund	48	80.00	42	70.00
Low yield of local seed	46	76.66	38	63.33
Fragmentation and subdivision of land	37	61.66	40	66.66
High interest of loans from private agencies	34	56.66	38	63.33
Scarcity of family labour	40	66.66	30	50.00
Lack of technical communication	30	50.00	35	58.33
More attachment to social norms and culture	26	43.33	32	53.33

different constraints in adoption of farming systems by the sample farmers in the study area are presented in Table 3.

Lack of training facilities was expressed by all small and marginal farmers. High market price fluctuations were expressed by 93.33 and 86.66 per cent of small and marginal farmers respectively. Nearly 78 and 88 per cent of small and marginal farmers respectively expressed lack of credit facilities as one of the major constraint for adoption of farming systems.

Further, about 83.33 per cent of small farms and 75 per cent of marginal farms opined that high input costs in usage of seed, fertilizers and pesticides. While 80 per cent of small farms and 70 per cent of marginal farms expressed scarcity of owned fund and about 76.66 per cent of small farms and 63.33 per cent of marginal farms opined low yield of local seed.

The other constraints in adoption of farming systems as expressed by sample farmers include fragmentation and sub division of land by 61.66 per cent of small farms and 66.66 per cent of marginal farms, high interest rate of loans from private agencies by 56.66 per cent of small farms and 63.33 per cent of marginal farms, scarcity of family labour by 66.66 per cent of small farms and 50 per cent of marginal farms, lack of technical communication by 50 per cent of small farms and 58.33 per cent of marginal farms, more attachment to social norms and culture by 43.33 per cent of small farms and 53.33 per cent of marginal farms. Shrey et al. (2015) also identified lack of training and credit facilities as major constraints in adoption of crop-dairy mixed farming system by small farms.

### CONCLUSIONS

Among the predominant integrated farming systems adopted by small and marginal farms, Paddy + Sericulture + Poultry, Paddy-Paddy + Tomato + Goat + Poultry, Paddy + Dairy + Moriculture and Paddy-Paddy + Tomato + Cotton + Goat + Poultry were found to be returning maximum as indicated by their highest return per rupee spent values that is, 1.89, 1.78, 1.70 and 1.72,

respectively. Of the different components indicated in various farming systems adopted by small and marginal farms poultry followed by sericulture, vegetable crops and dairy were observed to be remunerative as indicated by their maximum return per rupee spent values. Lack of training facilities, high market price fluctuations, lack of credit facilities and high input costs are the major constraints in adoption of farming systems by the sample farmers income security is fundamental to keeping agriculture as a choice for the younger generation. Agriculture promotes job-led economic growth, while modern industry promotes job-less growth. Jobless growth is also joyless growth and, therefore, it is important that farmers and farming are given adequate support in order to keep them engaged in farming and, thereby, preserve our food security and sovereignty.

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## Innovative Approaches for Rural Livelihood Security through Integrated Farming System (IFS)

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### ABSTRACT

Indian as well as global agriculture will face several challenges over the coming decades because it must produce more food to feed affluent and growing populations. Improving agricultural productivity while conserving and enhancing natural resources is also another problem in Indian agriculture. The solution of aforesaid problem in changing scenario is sustainability in agriculture production. In India, rural economy suffers from poverty, unemployment, malnutrition, limited diversification of farming and degradation of natural resources such as water, land and forest. Livelihood diversification is essential for poverty reduction, food security, rural livelihood security and improved income for rural farming community. Sustainable agriculture policies can better serve the goal of poverty reduction as well as rural livelihood security. The efforts to stimulate and support to the sustainable agricultural growth are essential for the rural livelihood security and rural development in India.

### Keywords

Integrated farming systems, livelihood, rural, sustainable

### JEL Codes

H11, O13, Q01, R28

### INTRODUCTION

IFS is a multidisciplinary farm approach and very effective in solving the problems of small and marginal farmers. The approach aims at increasing income and employment from small-holding by integrating various farm enterprises and recycling crop residues and by products within the farm itself. The farmers need to be assured of regular income for living at least above poverty line. The progress in production or steady growth in output is necessary to face the challenges posed by present economic and technological environment. In this context, farming system approach is one of the important solutions to face this peculiar situation as in this approach the different enterprises can be carefully undertaken and the location specific systems are developed based on available resources which will result into sustainable development. Integration of various agricultural enterprises viz., cropping, animal husbandry, fishery, forestry etc. in the farming system has great potentialities in agricultural economy. These enterprises not only supplement the

income of the farmers but also help in increasing the family labour employment throughout the year. The demand for food is increasing day by day due to decreased food production; there is continuous conversion of agricultural lands to residential lands and also the number of farmers working in the field is drastically reduced (Dadabhau & Wadkar, 2013). The primary objective of the IFS is to maintain production of food and other goods and services that contribute to food security and income generation to the rural poor. Integrated farming systems are often viewed as a sustainable alternative to commercial farming systems particularly on marginal lands with the objective of reversing resource degradation and stabilizing farm incomes. These integrated farming systems required to be planned, designed, implemented and analyzed for increasing productivity and profitability. These systems also need to be socially acceptable, economically viable and eco-friendly.

### What is Sustainable Rural Livelihood?

Capability, equity and sustainability combine in the

concept of sustainable livelihood. The concept Sustainable Rural Livelihood (SRL) is an attempt to go beyond the conventional definitions and approaches to poverty eradication. These had been found to be too narrow they focused only on certain aspects or manifestations of poverty, such as low income, or did not consider other vital aspects of poverty such as vulnerability and social inclusion. It is now recognized that more attention must be given to the various factors and processes which either constrain or enhance poor people's ability to make a living in an economically, ecologically and socially sustainable manner. The SRL concept offers a more coherent and integrated approach to poverty alleviation. To achieve sustainable rural livelihoods different livelihood capitals such as human capital, social capital, natural capital, physical capital and financial capital would play a greater role to cope with shocks and stresses and maintain or enhance the individual's capabilities and assets both in present and in the future without degrading the natural resource base.

### **Why Integrated Farming Systems**

#### **Deteriorating resource Base**

During post-green revolution period, our attempt to solve food problem and attain self-sufficiency in food production through excess use of agrochemicals, inevitable dependence on irrigation and high cropping intensity has led to contamination of food with harmful chemicals, pollution of ground water, degradation of soil quality and damage to agriculturally beneficial microorganisms.

#### **Climate Change**

The increasing green-house gases resulted in global warming. The Intergovernmental Panel for Climate Change (IPCC) projections on temperature predicts an increase of 1.8 to 4.0°C by the end of this century. Temperature and sea level changes will affect agriculture through their direct and indirect effects on crops, soils, livestock, fisheries and pests. The brunt of environmental changes is expected to be very high in India due to greater dependence on agriculture, limited natural resources, alarming increase in human and livestock population, changing pattern in land use and socio-economic factors that pose a great threat in meeting the food, fiber, fuel and fodder requirement.

#### **Narrowed Biodiversity**

The narrowing of genetic biodiversity occurs as traditional crop varieties and local animal breeds are being replaced by modern ones. These new varieties/breeds are certainly better matched to modern intensive agriculture but rarely any consideration is given to preserving the bio-diversity of an agricultural ecosystem. In addition, the increased farming density tends to erode the biodiversity of flora and fauna in the agricultural ecosystems.

#### **Multiplicity of Integrated Farming Systems**

Very often, almost all Indian farmers, in pursuit of supplementing their needs of food, fodder, fuel, fiber and

finance resort to adopt integrated farming systems, majority of them revolving around the crops + livestock components. Livelihood of small and marginal farmers, comprising more than 80 per cent of total farmers, depends mainly on crops and livestock, which is often affected by weather aberrations. Under present scenario, in the absence of scientifically designed, economically profitable and socially acceptable appropriate integrated farming systems models, they are unable to harness the benefits of integration.

#### **Low Rate of Farm Resource Recycling**

In the absence of adequate knowledge among farmers about techniques and benefits of recycling of farm, industrial and municipal organic wastes in agriculture, these remain unutilized. A vast untapped potential exists to recycle these solid and liquid organic wastes of farm origin. Recycling of crop residues may be a potential organic source to sustain the soil health. In corporation of crop residues of either rice or wheat increases the yield of rice and nutrient uptake and also improves the physico-chemical properties of the soil, ensuring better soil environment for crop growth.

#### **Technology Adoption Gaps**

In our efforts to develop and improve upon existing technologies, involvement of people in conceptualization and extension of technologies would appear very important. The farm family had never been the focal point of our investigations. This top down approach had given a poor perception of the problems that they tried to solve. Due to poor extension mechanisms at national as well as state levels, many farmers, especially those at lower strata of social structure, remain uninformed about many of the development schemes and the desired impact of such schemes is not obtained. One of the reasons for poor rate of transfer of agricultural technologies is poor linkages between the different clientele groups of agriculture. The basic aim of IFS is to derive a set of resource development and utilization practices, which lead to substantial and sustained increase in agricultural production. Hence, integrated farming systems are often viewed as a sustainable alternative to commercial farming systems particularly on marginal lands with the objective of reversing resource degradation and stabilizing farm incomes.

#### **Benefits of Integrated Farming Systems**

1. Productivity: IFS provides an opportunity to increase economic yield per unit area per unit time by virtue of intensification of crop and allied enterprises.
2. Profitability: Use waste material of one enterprise at the least cost as input for other enterprise. Thus, reduction in cost of production, from the utilization linkage of waste material and elimination of middleman interference in most input used.
3. Sustainability: Organic supplementation through effective utilization of byproducts of linked

component is done thus providing an opportunity to sustain the potentiality of production base for much longer period.

4. **Balanced food:** IFS links components of varied nature enabling to produce different sources of nutrition for farm families.
5. **Environmental safety:** In IFS, waste materials are effectively recycled by linking appropriate components, thus minimize environment pollution.
6. **Income round the year:** Interaction of enterprises with crops, eggs, milk, mushroom, honey, fish, cocoons, etc provides flow of money to the farmers round the year.
7. **Employment generation:** Combing crop with livestock enterprises would increase the labour requirement significantly and would help in reducing the problems of under employment to a great extent.
8. **Agro-industries:** When one of produce linked in IFS are increased to commercial level there is surplus value addition leading to development of allied agro-industries.
9. **Increasing input efficiency:** IFS provide good scope to use inputs in different components efficiently and effectively.

The majority of the people in India makes out their existence directly or indirectly from farm related economic activities because agriculture is an integral part of everyday life in Indian sub-continent, not only for it employs about 70 per cent of workforce of the country, but also for it provides food to the population, raw materials for the industries, wood for fuel and shelter, herbs for medicines, and above all means of sustenance and livelihoods. Agriculture sector for developing economies like India is primary source of livelihood in both farm and non-farm sectors and sustainability in agriculture sector means boosting up the rural livelihood system.

Sustainable agriculture and rural development are integral and necessary components of sustainable development. Sustainable agriculture involves all three pillars of development-economic, social and environmental. Agriculture and rural development are sustainable when they are ecologically sound, economically viable, socially just, culturally appropriate humane and based on a holistic scientific approach. This means that sustainable agriculture and rural development action programmes, including farming, forestry, and fisheries must meet the nutritional requirements and other human needs of present and future generations, provide durable and decent employment, where possible, enhance the productive and regenerative capacity of the natural resource base, reduce vulnerability and strengthen self-reliance. Rural men and women, especially in poor households, engage in diverse and multiple activities to improve their livelihoods by maximizing income-

generating activities, while minimizing vulnerability and risk, and achieving other household objectives (improved health, nutrition and education, etc). These activities may include farm and non-farm actions, many times linked with other activities carried out by rural, as well as non-rural households. The effectiveness and profitability of these diverse livelihood systems will vary depending on the general development environment, each household member's access to and control of the asset base, their productive and reproductive roles and responsibilities, their capabilities and their linkages with other rural and urban sectors (Channabasavanna *et al.*, 2009).

#### **Role of Sustainable Agriculture in Rural Livelihood Security**

In developing countries, where a majority of families derive their livelihoods from agriculture, sustainable agriculture cannot be discussed in isolation of sustainable rural livelihoods. Sustainable rural livelihood is a multifaceted concept and refers to maintenance or enhancement of access of rural families to food and income-generating activities on a long-term basis. Acharya, 2006 suggested four principal ways of acquiring livelihoods by the rural households

1. **Production-based Livelihood** - A large proportion of the small and marginal farmers gain livelihoods through production on small pieces of land. For these households, availability or access to inputs and improved methods of production are quite critical for their livelihoods.
2. **Labour-based livelihood** - Most of the small landholders and landless rural households derive livelihoods by selling their labour. For their livelihoods, demand for labour, wage rates and prices of food are the critical factors.
3. **Exchange or Market Based Livelihood** - Those rural households which produce surplus food and non-food agricultural products or non-farm goods earns their livelihoods by selling these surpluses in the market. The marketing system for these products and relative prices of what they sell and what they buy, affect their livelihoods.
4. **(iv) Transfer based entitlements** - The households without any income-earning asset or able-bodied person to work depend for their livelihoods on transfers from the government or other social organizations.

In the Indian context, where average farm-size is very small, and poverty and food-security continue to be preponderant among small landholders, the notion of sustainable agriculture ought to be viewed in the context of need for enhancement of productivity, production and profitability of agriculture and above all, for improvement in the economic conditions of farmers. All these need a careful and in-depth analysis. In this regard, the Situation Analysis Study of Indian farmers was conducted by NSSO as a part of Millennium Study of

Union Ministry of Agriculture, has brought out some highly relevant and interesting results, some of which are: (i) An estimated 27 per cent of the farmers do not like farming because it is not considered profitable, (ii) Nearly, 40 per cent of the farmers, if given a choice, would prefer to take up some other career, (iii) There is very low level of awareness among farmers about the modern eco-friendly technologies like use of bio-fertilizers, IPM and IPNM as well as of government programmes like MSP, crop insurance and agri-export promotion (iv) Many farmers have reported non-availability of modern inputs within the villages (v) Smallholders' dependence for livelihoods on dairying and other animal husbandry activities is higher than that of not-so-small farmers.

### **Issues in Sustainable Agriculture and Rural livelihood security**

Food and Agriculture Organization (FAO) - Sustainable agriculture as the management and conservation of resource base and the orientation of technological and institutional changes in such a manner that ensures attainment and continued satisfaction of human needs of present and future generations. It follows that, sustainable agriculture is that path of agricultural development, which is environmentally non-degrading, technologically appropriate, economically viable and socially acceptable. It must be recognized that agriculture by definition is the most aggressively managed ecosystem, which is closely linked to the world's food system. If the alternative to agricultural sustainability is the collapse of the world's food system, there is definitely no compromise. However, in predominantly rural economies like India, growth of agriculture is critical to the achievements of goals of poverty reduction and household food-security. This requires resolution of the issue of trade-off between sustainable agriculture and a growing agriculture. While sustainable cropping and farming systems, recent trends in profitability of farming and some new approaches like organic farming should be discussed, there are some other areas which need increased attention for achieving sustained growth of agriculture coupled with improved livelihood systems in the country (Dev, 2014).

The strategic approach to sustained growth of agriculture that helps in improving rural livelihoods should encompass the following:

- a. The developing countries, like India, cannot and should not ignore the fact that the priority goal of agricultural development ought to be the removal of hunger, lifting all above the poverty line, and removing malnutrition among children.
- b. There is a debate between protagonists of agricultural development and environmentalists. While those who give precedence to the removal of hunger and food insecurity suggest that irrigation facilities should be expanded further, environmentalists argue that water use in agriculture should be brought down. However,

the best course to reconcile the conflicting objectives is to adopt a strategy which increases water-use efficiency, measured as maximum biomass per drop of water.

- c. Now days, it is argued that the main problem with current agricultural development paradigm is that it is a shift away from the traditional system of water and natural resource management. In this context, it should not be forgotten that current socio-economic environment is distinctly different from an environment in which traditional system was evolved and had worked.
- d. India receives about 4000 billion cubic metres (BCM) of water annually in the form of precipitation/rainfall. Nearly, 75 per cent of this is received within 100 hours. Harnessing water through either surface or subsurface water storage structures is, therefore, inevitable. However, so far, only 1900 BCM of water is utilized for irrigation, which accounts for around 90 per cent of total water utilized in the country. Nearly, one-third of the total water is received in the Ganga, Brahmaputra and Meghna basins. Rest of the country's area receives two-thirds of total precipitation in India. Given such an uneven distribution of rainfall, floods in some regions and droughts in several other regions are bound to occur. There is, therefore, a basis for launching a long-term programme of linking different river basins of the country to tackle the problems of floods and droughts for achieving the twin goals of sustainable agriculture and improved rural livelihoods.
- e. A related issue is the management of available water resources. Within the next two decades, it is predicted that India will face absolute water scarcity, deepening 'water poverty' further. Integrated water resources management (IWRM) is considered as a package of best practices for improved management of water resources with strong emphasis on direct demand-side management. The instruments of IWRM package include (a) national and state water policies to guide all the players; (b) a water law and regulatory framework; (c) treating water as an economic good and appropriately pricing it; (d) creation of tradable water rights; and (e) participatory management of water resources. Nearly, 80 per cent of India's rural households self-supply their domestic water requirements and are not connected with any formal water provider. In the case of irrigation, while farmers served with canals can be assumed to be connected to 'formal water economy'. NSSO (2003) survey shows that 80 per cent of villages use irrigation mostly from wells, tanks and

streams without being connected to or with any administrative system. Making direct demand management work in this situation is considered closer to impossible.

- f. Consumption patterns of a large section of the population (middle and upper middle class) are changing rapidly, leading to a substantial increase in resource intensity of consumption. Nevertheless, the rising trend in resource intensity of consumption cannot be brushed aside for sustainability of natural resources. To address the problem, there is a need for adopting and inculcating a model based on three (3) R's, i.e. Reduce, Reuse and Recycle.
- g. Another issue in sustainable agriculture and rural livelihoods is the energy security. Due to the change in life-styles, the energy needs are growing rapidly. Further, the oil supplies are becoming costlier and unstable. India's import dependence on petroleum products is very high. This, naturally, has made bio fuels an area of increasing attention.
- h. Sustainable use of natural resources requires that policy formulation, planning and development decision-making. There is not enough knowledge and consciousness of environmental costs at all the stages of decision-making and policy formulation.
- i. As there is an element of trade-off between environmental protection and welfare loss of the present generation, valuation of individual and social costs and benefits is quite critical in development decisions.

#### **Approach allowed several developments:**

1. Technical scientists were increasingly sensitised to the complexity and variability of farmer's production environment. They recognised that, this environment consisted of both physical and socioeconomic components.
2. The farm is understood as one system. For example the livestock farming system approach proposed by animal scientists considers the farmer, the herd and the resources as one socio-technical system.
3. Economists realised that, farmers behaviour could not be understood only through maximisation of profit. In his adaptive behaviour theory, showed how farmers interactively adjust both their objectives and their situations. For farmers and farm households, choices also take into account issues such as long-term preferences, security, lifestyle and quality of life (Bairwa *et al.*, 2014).

#### **Government Policies and Institutions**

The incentives to innovate and adopt better technologies, as well as to invest in agriculture, depend on the overall policy environment, including macro-

economic and sectoral policies and regulations. The policy set in developing countries has historically led to a clear bias against the agricultural sector. Diminished incentives for farmers to invest and expand production are significantly related to protection of non-agricultural sectors. More recent estimations reveal that over the past four to five decades the nominal rate of protection afforded to non-agriculture steadily declined for developing countries as a whole, from 45% in the 1960s to less than 10% in the 1990s. This trend has contributed more to a decline of net taxation of agriculture than specific agricultural support policies.. Policy-induced failures and the lack of enabling institutions constrain the productivity of small family farms. Of particular concern are poor policies and institutions that grant smallholders limited control over land and water resources on which their productive activities and livelihoods depend. An estimated 1 to 2 billion people globally live on and use commonly held land over which they have no legal title. Poorly defined property rights limit their access to credit and insurance markets, and prevent them from investing in improved environmental sustainability and natural resource management. The impact of specific agricultural support policies on farm productivity depends on how and why it is delivered. Commodity-based support has the largest impact on production, but protecting farmers from competition does not encourage them to increase productivity. Market interventions often treat the symptoms of market failure and under-development rather than the cause. For example, food price stabilization can provide a more stable investment climate but can also impose very high costs on consumers, thwart the development of private risk management, and can export instability onto world markets. It also thwarts the development of the private sector which is crucial for the long-term development of the food sector. Like price support, input subsidies also distort production (Acharya, 2006). However, they can redress, at least temporarily, market failures such as the under-development of infrastructure, missing markets for credit and inputs and a lack of knowledge of the benefits of using improved seeds, animal breeds and fertilizer. To this extent, they can help farmers acquire improved technology, and thus foster productivity, but over time they can also impede the development of private markets and do not tackle the problem of market failure directly (Kumar *et al.*, 2006). More generally, if support is targeted to a specific input, it can encourage an input mix that will not necessarily be economically or environmentally sustainable. As seen earlier, public expenditures on agricultural R&D have positive and large impacts on agricultural productivity, but public expenditures on extension and advisory services are also important and complementary as they promote the adoption of new production systems that enable productivity growth on a sustainable basis.

#### **CONCLUSIONS**

The IFS provide progressive economic growth,

employment opportunities, family nutritional requirements, optimal utilization of resources of the farming enterprises, etc. Further many researchers found many types of integrated farming system models existing in the country but it has not properly documented to reach the mass farmers. Hence, measures to be taken to document such kinds of farming system models and to disseminate to the needy farmers. Although the integrated farming system has certain constraints the scientific community and research station has to initiate steps to alleviate such problems of the farmers to improve their standard of living and income.

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## **Capsicum Cultivation under Protected Technology for Higher Income**

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### **ABSTRACT**

*The study analysed the differential in costs and returns structure of capsicum cultivation; use of plant protection chemicals and variability in yield and prices of capsicum under net house and open field production system. The study is based on primary data collected from 60 net house and 60 open field vegetable cultivators from Punjab state. The yield of capsicum was higher at 197 quintals per acre in net house than at 98 quintals per acre in open field cultivation. Gross returns over total costs were Rs 4.18 lakh and 1.69 lakh in open field capsicum cultivation respectively. The use of plant protection chemical was lower by 24.9 per cent in net house over open field cultivation whereas variability of yield and price was quite high in both the production systems.*

### **Keywords**

Capsicum cultivation, net house vegetable cultivation, open field cultivation,

### **JEL Codes**

O13,Q12,Q16

### **INTRODUCTION**

Vegetables form major and important part of our dietary requirements, which are widely grown in the rural and peri-urban areas. Vegetable crops are useful in rotational system of farming to maintain the fertility of soil. The continuity of wheat paddy rotation in Punjab has resulted in emergence of various problems related to soil and water such as increased salinity, nutrient deficiency, increase insect pest and diseases, excessive use of fertilizers for increasing yield and decline in the underground water table. Hence, Vegetable farming is being considered as one of the alternatives for diversification of Punjab agriculture, as vegetable crops give high returns per unit area as compared to rice and wheat (Sharma *et al.*, 2000). The diversification of farming with the vegetable production helps even the small farmers to earn sufficient income to make their livelihood (Kapila *et al.*, 1985).

The Hi-tech horticulture including protected cultivation of high value and exotic vegetables has been on the increase. Production of vegetables under protected conditions involves protection of vegetables at production stage mainly from adverse environment

conditions such as temperature, hails, scorching sun, heavy rains, snow and frost (Singh *et al.*, 1999). Net house and poly house technologies are widely used as protection technologies, especially for vegetable cultivation. Due to the population pressure, fragmentations of land holdings and urbanization have led to decline in cultivable area. Production of vegetables under protected cultivation system results in effective use of the land resources, besides being able to increase the production of quality vegetables by offsetting biotic and abiotic stresses to a great extent that otherwise is prevalent in open cultivation (Sidhu, 2011). The cultivation of vegetables in net house can play a better role in improving quality, advancing maturity as well as increasing fruiting span and productivity (Cheema *et al.*, 2004).

Capsicum, also known as sweet pepper, bell pepper or shimlamirch is one of the popular vegetables grown throughout India. Under protected cultivation, capsicums are widely grown due to higher productivity and economic feasibility. In the light of the facts mentioned above, the present study is planned in the Punjab state to examine the input use, cost, price, and yield differential of net-house cultivation vis-à-vis open cultivation of

capsicum. The specific objectives of study are:i) To examine the costs and return structure of capsicum cultivation in net house and open field;ii) To analyse the quality of capsicum produced under both the production techniques and;iii) To study the variability in profitability of capsicum cultivation under both the production systems.

### METHODOLOGY

The study is based on primary data collected from vegetable growers of Punjab State. For the selection of sample household, a list of net house vegetable growers was obtained from the officials of Punjab State Farmers' Commission, Mohali. A sample of 60 net house vegetable cultivators was selected from 12 districts of Punjab having high concentration of net house users. For comparison purpose an equal number of vegetable growers, cultivating vegetables in the open field were also selected either from the same villages or nearby villages. Thus, sample size comprised of 120 vegetable growers consisting of 15 small, 20 medium and 25 large net house vegetable cultivators; 23 small, 18 medium and 19 large open field vegetable cultivators. The data on input use, yield and prices in capsicum cultivation were collected from both categories of vegetable growers and converted on per acre basis to facilitate comparison. Data were collected during September 2012 to January 2013 for the reference year 2011-12. Simple averages and percentages were used to work out cost and return structure of capsicum cultivation under net house and open field.

### RESULTS AND DISCUSSION

#### Socio-economic profile of the respondents

The Socio-economic profile of the respondent farmers has great bearing on decisions regarding adoption of new technologies/techniques of production, risk bearing ability, investment decisions etc. The socio economic profile of respondent vegetable growers is presented in **Table 1** which revealed that the average age of farmers was

48 years in the case of net house cultivators and 45 years in the case of open field cultivators. Data further depicted a significant association between education and adoption of innovative technology; the average number of years in formal schooling was higher in net house vegetable growers than their counterpart open field vegetable growers. Percentage of farmers having education upto +2 and above were 43 and 28 respectively I both categories of farmers. The farmers having education up to graduation and post-graduation level were 31.7 per cent in the case of net house vegetable cultivation and 16.6 per cent in the case of open field vegetable cultivation. The size of operational holdings was larger for net house cultivators at 15 acres than open field vegetable cultivators at 12.52 acres. Among the net house vegetable cultivators, 30 per cent of the farmers were members of different societies/clubs and 12 per cent farmers amongst the open field cultivators had membership of societies/clubs.

The Table also revealed that the size of the family was about 6 members in net house vegetable cultivators and 7 members in open field vegetable growers. Majority of the working members engaged in agriculture were about 2 in the case of both the categories of farmers. The dependency ratio was lower at 1.92 members in the case of net house category than open field vegetable cultivators at 1.99 members. In terms of asset holdings, the information revealed that 90 per cent of net house cultivators and 83 per cent open field cultivators owned tractors. The ownership of electric motors was again high in the case of net house cultivators to the extent of 95 per cent while it was 86.7 per cent in the case of open field cultivators. The average investment in a net house structure was ₹1.15 lakhs and the subsidy given by the government was to the tune of ₹40,000 per net house structure during the survey period. Around 29 per cent of area was under vegetable cultivation amongst both the categories of farmers.

**Table 1: Socio-economic characteristics of sampled households**

Socio-economic parameters	Per cent of households	
	Net house cultivators	Open field cultivators
1. Average Age (in years)	48	45
2. Education (no of years in school)	11	9
a) +2 and above	43.3	28.3
b) Graduate and above	31.7	16.6
3. Size of operation holdings (acres)	15	12.52
4. Membership of Different Societies/Clubs	30.0	12.0
5. Family size (no.)		
6. Possession of agriculture machinery(per cent per household)		
a) Tractors	90.0	83.3
b) Electric Motors	95.0	86.7
7. Average Investment on net house structure (₹)	1.15 Lakhs	-
8. Subsidy (₹)	40,000	-
9. Area under Vegetables (per cent)	29.7	29.0

Overall it was observed that net house vegetable cultivators were more educated, had large size of operational holding and have members working in agriculture. More of the net house vegetable cultivators had membership of different societies/clubs. Machinery in terms of tractors and electric motors were high in the case of net house vegetable cultivators than open field vegetable growers.

**Cost and return structure of capsicum cultivation in net house and open field**

The capsicum is important vegetable grown by the net house vegetable growers. For the cost structure only paid out costs were considered. The costs items included are costs on seedlings, chemical fertilizers, plant protection chemicals, plant stimulants, irrigation, hired labour, transportation costs and costs of permanent structure erected to support the vegetables and low tunnels formed to protect vegetable during winter season from frosts. The information on cost structure of capsicum cultivation under net house and open field in Punjab is presented in Table 2.

**Table 2: Cost structure of capsicum cultivation under net house and open field in Punjab**

Particulars	(₹/acre)			
	Net house		Open field	
	Amount	Per	Amount	Per
Seedlings	12998	18.00	10424	20.16
Chemical fertilizers	2793	3.87	2487	4.81
Farm yard manure	3064	4.24	2254	4.36
Plant stimulants	1390	1.92	205	0.40
Plant protection chemicals	3800	5.26	5060	9.78
Irrigation	500	0.69	600	1.16
Machinery	978	1.35	922	1.78
Hired labour	33690	46.64	20228	39.12
Low tunnel cost	6500	9.00	7200	13.92
Transportation cost	6520	9.03	2334	4.51
<b>Total variable cost</b>	<b>72233</b>	<b>100.0</b>	<b>51714</b>	<b>100.0</b>

The comparison of costs of capsicum cultivation in net house and open fields in Punjab in Table 2 reveals that the total cost of cultivation and marketing cost of capsicum (paid out costs) in net house was estimated at ₹72,233 per acre and in open field at ₹51714. The maximum expenditure was made on hired labour which constitutes 46.64 and 39.12 per cent of the total cost of capsicum cultivation under net house and open field respectively followed by cost of seedlings. Among the other items of costs the expenditure on plant protection chemical, which formed 5.26 and 9.78 per cent of the total cost being higher in open field than net house. The expenditure on permanent fixtures was estimated at ₹6500 and ₹7200 per acre for net house and open field cultivation of capsicum. The other important items of expenditure were fertilizer,

farm yard manure, machinery etc. The transportation charges were also an important item of cost constituting 9.03 and 4.51 per cent of total costs.

The average yield per acre of capsicum cultivated in net house was observed to be 197 quintals and in open fields it was 98 quintals as shown in Table 3. On an average the net house vegetable growers fetched lower price at ₹2125 per quintal and for the open field product it was ₹2250 per quintal during the study year.

The gross returns were estimated at ₹4, 18,625 and ₹2, 20,500 per acre under net house and open field respectively from capsicum cultivation. Amortized cost of net house investment was estimates using 9 percent rate of interest assuming 10 years life of the structure and nine months crop period. The returns over total costs were estimated at ₹276273 and ₹168687 in respective situations. Returns from net house capsicum cultivation were quite higher than open field cultivation of capsicum.

**Variability in Yield and Price of capsicum cultivation**

The profitability of any crop cultivated by the farmer depends upon the yield of the crop at harvesting time and price of the produce received at the time of marketing of the produce. The vegetable being seasonal and perishable in nature are subjected to high volatility in prices and yield resulting into variability in returns from vegetable cultivation. For estimating the gross returns from capsicum cultivated in net house and open field, the average yield and price received by the sample vegetable growers were used. The information relating to minimum and maximum price/yield was compiled; coefficient of variation (CV) was estimated for different vegetables grown in net house and open field situation and presented in Table 4.

The estimates are given on per acre basis. Higher variability in yield in the case of capsicum was observed in net house (49.21 per cent) and in open field (23.71 per cent). The yield of capsicum ranged between 57 quintals per acre to 400 quintals per acre in net house; 40 quintals per acre to 120 quintals per acre in open field. It shows that the yield of capsicum was quite high in net house than open field cultivation on per acre basis. These findings supported the study conducted by Singh & Asrey (2005) which states that the cultivation of capsicum under green house has not only helped in getting higher productivity

**Table 3: Return structure of capsicum cultivation under net house and open fields in Punjab**

Particulars	Net house	Open field
Yield (q/acre)	197	98
Price (₹/q)	2125	2250
Gross returns (₹)	418625	220500
Variable costs	72233	51714
Amortized costs of net house investment (₹)	70119	-
Total costs	142352	-
Returns over total costs	276273	168687

**Table 5: Difference in expenditure on plant protection chemicals and fertilizers in capsicum cultivation in net house and open field in Punjab**

Particulars	Net house cultivation	Open field cultivation	Difference in expenditure	Per cent age difference
Expenditure on plant protection chemicals	3800	5060	-1260	-24.90
Expenditure on chemical fertilizers	2793	2487	306	12.30

**Table 4: Variability in yield and prices of capsicum cultivation in net house and open field in Punjab**

Particulars	Net house	Open field
Yield (q./acre)		
Minimum	57	40
Maximum	400	120
Coefficient of variation (CV)	49.21	23.71
Prices (₹/q)		
Minimum	700	800
Maximum	5000	2200
Coefficient of variation (CV)	41.65	28.49

but also fetch better returns.

In the case of net house the minimum sale price of capsicum was Rs 700 per quintal whereas the maximum price was ₹5000 per quintal, the CV of price was estimated at 41.65 per cent, which shows large variation in the price. On the other hand the price of capsicum grown in open field ranged from ₹800 to ₹2200 and the CV of price was computed at 28.49 per cent. It shows that the yield of capsicum is quite high under net house structure.

#### **Expenditure on plant protection chemicals and fertilizers in capsicum cultivation**

Excessive and indiscriminate use of pesticides not only increases the cost of production but also results in many human health problems and environmental pollution (Nasir, 1999). The effect of chemical pesticide use is more harmful in vegetables. The cultivation of vegetables in net house is expected to reduce the expenditure on pesticides use. Table 5 incorporates information relating to expenditure made by farmers on plant protection chemicals to control the insect and pest in vegetable cultivation in net house and open field on per acre basis. It is clear from the table that the expenditure on plant protection chemicals was less in capsicum cultivation in net house than in the open field. The

difference in plant protection chemical expenditure was lower by 24.90 in net house cultivation than open field cultivation. Correspondingly, the chemical fertilizer applied on capsicum cultivation was higher in net house by 12.30 per cent than the open cultivation.

#### **CONCLUSIONS**

Overall it is concluded that capsicum cultivated in net house yield high returns and better in quality grounds in terms of less plant protection chemical use. It is a capital and labour intensive activity, which gives higher profit per unit area. The significant difference observed in the yield from protected conditions and open conditions, consequently increased the profit of farmers manifold. Thus awareness should be created among the farmers for adoption of net house technology and consumers about the quality of vegetables cultivated in net house. High variability in price and yield of capsicum make the crop risky even under protected conditions. Thus there should be government support to the net house vegetable growers for creating special market for their produce for better price than the open field product.

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## Estimating the Determinants and Factors Affecting the Profitability of Small Dairy Farms in Punjab

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### ABSTRACT

The present study was undertaken to evaluate the economic viability of small dairy farmers in terms of herd size and animal type in Faridkot district of Punjab. Simple random sampling technique was used and a sample of 100 farmers was selected from two blocks of Faridkot district for primary data collection. Selected respondents were classified according to herd size and animal type. In the case of animal type, the highest net returns per animal per year were ₹42712, in the case of mixed composition as compared to only buffaloes or only cows i.e. ₹39680 and ₹37060, respectively. However, in the case of herd size, net returns per farm were ₹142154, 312536 and 453122 for categories of number of animals less than 5, 6-10 and above 10, respectively. Cobb-Douglas analysis showed that independent variables herd size, animal shed and veterinary expenses are significant and have positive relation with total returns.

### Keywords

Animal type, herd size, Punjab, small dairy farms

### JEL Codes

C81, Q01, Q10, Q13, Q18

### INTRODUCTION

The agricultural economy of Punjab is no longer among the fastest growing in the country due to stagnation/reduction in incomes from agriculture which has adversely affected resource poor farmers, especially small farmers (having less than 5 acres of land). The small farmers of Punjab are trying to chase environmentally and economically unsustainable agrarian practices and accumulating high debt (especially in Malwa region of Punjab) and also lacking alternative sources of income (Singh & Manisha, 2015). Therefore, to boost the agricultural growth rate and improve the income level of these resource poor small farmers in the state, moving forward from wheat-rice rotation and decreasing dependency on land for crop production some alternative enterprises must be promoted. Livestock is being considered as one of the viable options for diversifying the agricultural economy of the state.

In a normal year, crop production can generate employment only for 90 to 120 days and in the remaining period farmers are virtually unemployed. In this situation, dairying sets right this imbalance in employment

(Anonymous, 2010). In the contemporary era, when the majority of rural people have small landholdings, the livestock production is expected to be pro-poor and vibrant in reducing poverty (Birthal & Taneja, 2006). Above this, advantages like regular income, ever increasing demand of milk and milk products in the rising population promises ample scope for this sector.

Moreover, the demand for milk is projected to be 200 million tons by 2030 which shall be further propelled due to increasing middle class population with high disposable income along with fast changing socio-economic and cultural values and health consciousness (Anonymous, 2011). The Government of Punjab, in the last few decades, has envisaged increased milk production through massive programmes of training to the farmers, key village schemes, intensive cattle development programmes, production of higher quality feeds, proper health care of animals etc. Consequently, the milk production in Punjab has increased to 103.51 lakh tons (Anonymous, 2015). Considering its importance and future prospects, an attempt has been made to find out the profitability of milk production and effect of herd size and animal type upon it.

**METHODOLOGY**

A field survey using pre-prepared schedule was conducted and a sample of 100 small farmers was selected using simple random sampling technique from a cluster of 2 blocks of Faridkot district. The information was collected from the farmers regarding herd size, composition of animals, investments on dairy farming, constraints faced by dairy farmers, fixed and variable costs incurred on buffaloes, crossbred cows and local cows along with milk output and returns per litre milk. For estimating the effect of herd size, selected farmers were divided into 3 categories *i.e.* Less than 5, 6-10 and above 10. Apart this, for the estimation of animal type on profitability classification was done according to composition type *i.e.* only buffalo, only cow or mixed composition.

**Analysis of data**

Simple statistical tools like percentage, averages etc. were used in the initial stage to analyze the collected data. However, taking into account the objective of the study following advanced statistical technique was used.

**Functional Analysis**

To examine the factors affecting value productivity of milk production, both linear and log-linear production function were fitted and numerous equations were tried by taking different explanatory variables. Best fit function was determined on the basis of level of significance of the explanatory variables, the value of coefficient of multiple determinations ( $R^2$ ) and the logical signs of the explanatory variables included in the model. Cobb-Douglas function of the following form was considered the most appropriate for the present investigation:

$$Y = A \prod_{i=1}^n X_i^{b_i} e^u$$

Where,

'Y' represents the Total returns from dairy farm

'X<sub>i</sub>' the selected explanatory variables per dairy farm in value terms

'A' the technical efficiency parameter and 'b<sub>i</sub>' the coefficient of production elasticity of the respective variable 'X<sub>i</sub>' at the mean level of input used and output obtained

'e' is an error term

The estimated form of the equation becomes:

$$\text{Log } Y = \text{Log } A + \sum_{i=1}^n b_i \text{ log } x_i + u$$

$$\text{Log } Y = \text{Log } A + b_1 \text{ log } x_1 + b_2 \text{ log } x_2 + \dots + b_n \text{ log } x_n + u$$

The functions were fitted for overall scenario for the study.

**Statistical significance of the estimates**

To test the statistical significance of these estimates, t-value of the estimates was worked out at (n-k) degrees of freedom. The t-value of the regression coefficients (b<sub>i</sub>) were worked out as under:

$$t_{(n-k)} = \frac{b_i}{S.E.(b_i)}$$

Where S.E. is the standard error of the variable X<sub>i</sub>

**Coefficient of multiple determination ( $R^2$ )**

The coefficient of multiple determination was worked out to estimate the proportion of variations in total returns from dairy farm as explained by the different explanatory variables, taken together in the analysis. Statistical significance of  $R^2$ , which examines the goodness of fit of the function, was tested by working out F-ratio as follows:

$$F = \frac{R^2 / K}{(1 - R^2) / n - k}$$

Where,

'R<sup>2</sup>' is the value of the coefficient of multiple determination

'n' is the number of observations

'k' is the number of parameters included in the study

The estimated form of the equation becomes:

$$\text{Log } Y = \text{Log } A + b_1 \text{ log } x_1 + b_2 \text{ log } x_2 + b_3 \text{ log } x_3 + b_4 \text{ log } x_4 + b_5 \text{ log } x_5 + b_6 \text{ log } x_6 + b_7 \text{ log } x_7 + b_8 \text{ log } x_8 + u$$

Where,

Y = Total returns from dairy farm

x<sub>1</sub> = Herd size

x<sub>2</sub> = Animal type

x<sub>3</sub> = Dry fodder

x<sub>4</sub> = Concentrates

x<sub>5</sub> = Animal shed cost

x<sub>6</sub> = Veterinary expenses made for health maintenance of dairy animals

x<sub>7</sub> = Educational status of dairy persons

x<sub>8</sub> = Age of the dairy farmers

**RESULTS AND DISCUSSION**

**Herd-size Composition**

The information regarding the herd-size composition on different farm-size categories in Faridkot district is presented in Table 1. It was observed that crossbred cows constitute a major proportion in the total milch animals in Kotkapura block while in Faridkot block the scenario was different *i.e.* buffaloes constitute the larger proportion in the total milch animals. Out of the total milch animals, the average number of buffaloes, crossbred cows and local cows in Kotkapura block was 1.80, 1.40 and 0.12 on small farms, 4.30, 4.43 and 0.40 on medium farms and 0, 10 and 4.5 on large farms, respectively, meanwhile the corresponding figures for Faridkot block were 2.04, 1.95 and 0.10 on small farms, 4.60, 4.70 and 0.63 on medium farms and 7.00, 13.80 and 0.20 on large farms, respectively.

The Table further revealed that on small farms in Kotkapura block, the average number of milch, draught and young animals in the total herd-size was found to be 3.32, 0.47 and 0.61, respectively. Corresponding to this, the average in the case of small farms in Faridkot block was of the order of 4.09, 0.37 and 0.53, respectively. On medium farms, the average number of milch, draught and young stock was 9.13, 0.38 and 1.2, in Kotkapura block and 9.93, 0.46 and 0.95 in Faridkot block, respectively.

**Table 1: Herd composition on different dairy farm size categories**

Composition	Small		Medium		Large		Overall	
	Average	Percentage	Average	Percentage	Average	Percentage	Average	Percentage
<b>Kotkapura</b>								
Buffaloes	1.80	54.21	4.3	47.09	-		2.03	33.76
Crossbred Cows	1.40	42.16	4.43	48.52	10	68.96	5.27	53.21
Indigenous Cows	0.12	3.61	0.40	4.38	4.5	31.03	1.67	13.00
Total Milch Animals	3.32	100.0	9.13	100.0	14.50		8.98	100.0
Calves & Heifers	0.61		1.2		1.98		1.26	
Bulls/He-Buffaloes	0.47		0.38		0.70		0.51	
Total Animals (SAU)	4.4		10.71		17.18		10.76	
<b>Faridkot</b>								
Buffaloes	2.04	49.87	4.60	46.32	7	33.33	4.54	43.17
Crossbred Cows	1.95	47.67	4.70	47.33	13.20	62.85	6.61	52.61
Indigenous Cows	0.10	2.44	0.63	6.34	0.80	3.80	0.51	4.19
Total Milch Animals	4.09	100.0	9.93	100.0	21.00	100.0	11.67	100.0
Calves & Heifers	0.53		0.95		1.62		1.03	
Bulls/He-Buffaloes	0.37		0.46		0.42		0.41	
Total Animals (SAU)	4.99		11.34		23.04		13.12	
<b>Overall</b>								
Total Milch Animals	3.70		9.53		17.75		11.94	

Similarly, on large farms, it was 14.50, 0.70 and 1.98 in Kotkapura block and 21.00, 0.42 and 1.68, respectively in Faridkot block. Overall, the average number of milch animals came to be 8.98, draught animals 0.51 and young stock 1.26 in Kotkapura block and 11.67, 0.41 and 1.03 in Faridkot block, respectively.

The dairy animals were converted into standard animal unit and the herd size according to the standard animal unit came to be 4.4, 10.71 and 17.18 on small, medium and large farms, respectively in Kotkapura block and 4.99, 11.34 and 23.04, respectively in Faridkot block. On the whole, it emerged that the average number of total milch animals was observed to be the highest in all the farm size categories in both the blocks. The average number of total milch animals was 3.70, 9.53 and 17.75 on small, medium and large farms, respectively.

#### **Cost-returns Structure per animal of dairy enterprise according to composition**

The cost-return structure of dairy enterprises on the sample farms has been given in Table 2. A perusal of the Table 2 revealed that aggregate total cost per animal in undertaking dairy enterprise on farms was worked out to be ₹50578 in case of buffaloes, ₹59254 in the case of cows and ₹55807 under mixed composition of animals. As far as variable cost is concerned, highest was in the case of cows ₹52899) followed by under mixed composition ₹49156) and least when buffaloes were under question ₹42408) per animal per year. Of this, the highest cost in the case of buffaloes and mixed composition was on dry fodder, which was ₹15702 and ₹15828, respectively.

Whereas, the scenario in the case of only cows was in

contrast, where concentrates occupied major share of variable expenditure ₹21382) was incurred on concentrates, followed by dry fodder ₹13487). Other point to be observed here is that net expenditure on concentrates per animal in the case of mixed composition dairy units undertaking was almost double than same in case of buffaloes, where as the ratio of same in case of buffaloes to cows was of 1:3. While the lowest cost was incurred on insemination charges, followed veterinary services in all composition types.

The cost of total fixed investment per animal per year came to be ₹8170, ₹6355 and ₹6651 on buffaloes, cows and mixed composition farms, respectively. Depreciation on animals (₹6032, ₹4560 and ₹4900) and depreciation on animal shed (₹738, ₹732 and ₹651) were the major fixed costs worked out, respectively in the case of buffaloes, cows and mixed composition farms. Least contributing factor to total fixed investment were depreciation on water structure immediately followed by depreciation on electric motor/diesel engine and depreciation on water structure in all categories under study.

The gross returns comprised of sale of milk, sale of young animals, cashing family labour and value of dung. The gross returns per animal per year were ₹90258 on buffalo dairy farms, ₹96314 on only cow farms and ₹98519 in mixed composition situation. The highest net returns per animal per year were ₹42712 in case of mixed composition whereas the same was ₹39680 and ₹37060 in the case of buffaloes and cows, respectively.

The major reason worked out behind the high profitability of mixed composition type undertaking is

**Table 2: Total cost-return structure of dairy enterprise on the sample farms in Punjab**

Particulars	₹/farm		
	Buffaloes	Cows	Mixed composition
<b>Variable cost</b>			
1 Cost of feed and fodder			
(i) Green fodder	9280	8496	8387
(ii) Dry fodder	15702	13487	15828
(iii) Concentrates	7556	21382	14012
2 Veterinary expenses	814	783	1309
3 Insemination charges	443	350	414
4 Human labour			
(i) Family labour	6340	4620	5200
(ii) Hired labour	1647	3000	3280
5 Interest on variable	626	781	726
Total variable cost	42408	52899	49156
<b>Fixed cost</b>			
1 (Depreciation) animals	6032	4560	4900
2 (Depreciation) animal shed	738	732	651
3 (Depreciation) fodder shed	390	342	336
4 (Depreciation) fodder cutter	150	99	84
5 (Depreciation) electric motor/diesel engine	130	71	90
6 (Depreciation) water structure	56	27	41
7 Interest on investment @ 9 per cent p.a.	674	524	549
Total fixed cost	8170	6355	6651
Total cost	50578	59254	55807
<b>Return structure</b>			
(i) Sale of milk	78411	86935	87340
(ii) Sale of animal dung	1253	1395	2372
(iii) Sale of young animals	4254	3364	3607
(iv) Cashing own labour	6340	4620	5200
<b>Gross return</b>	<b>90258</b>	<b>96314</b>	<b>98519</b>
<b>Net-return</b>	<b>39680</b>	<b>37060</b>	<b>42712</b>

Figures in parentheses are percentage of total

that it includes production of high fat content milk as well as greater quantity of milk production per day.

**Cost-returns structure for one animal of dairy enterprise according to herd size**

The cost-return structure of dairy enterprises on the sample farms has been given in Table 3. A perusal of the table reveals that in aggregate total cost per animal in undertaking dairy enterprise on farms was worked out to be ₹53699 in the case of size of dairy unit was up to 5, ₹56197 in the case of size of dairy unit was 6-10 and ₹56671 when same was above 10. As far as variable cost per animal is concerned, it goes on increasing as the size

**Table 3: Total cost-return analysis of dairy enterprise according to herd size**

Particulars	₹/animal/year		
	Up to 5	6-10	Above 10
<b>A Variable cost</b>			
1 Cost of feed and fodder			
(i) Green fodder	9032	8497	8256
(ii) Dry fodder	15400	15115	11820
(iii) Concentrates	13096	16248	20387
2 Veterinary expenses	1225	738	2065
3 Insemination Charges	414	400	333
4 Human Labour			
(i) Family Labour	5400	4785	2974
(ii) Hired Labour	1250	2688	4121
5 Interest on variable cost @ 9 per cent	687	727	749
<b>Total variable cost</b>	<b>46504</b>	<b>49198</b>	<b>50705</b>
<b>B Fixed cost</b>			
1 (Depreciation) animals	5179	5224	4627
2 (Depreciation) animal shed	718	726	490
3 (Depreciation) fodder shed	388	339	247
4 (Depreciation) fodder cutter	141	53	44
5 (Depreciation) electric motor/diesel engine	120	60	53
6 (Depreciation) water structure	55	20	13
7 Interest on investment @ 9 per cent p.a.	594	577	492
<b>Total fixed cost</b>	<b>7195</b>	<b>6999</b>	<b>5966</b>
<b>C Total cost</b>	<b>53699</b>	<b>56197</b>	<b>56671</b>
<b>Return structure</b>			
(i) Sale of milk	81783	78878	74697
(ii) Sale of animal dung	1317	1377	953
(iii) Sale of young animals	3619	3952	3575
(iv) Cashing own labour	5400	4785	2974
<b>D Gross return</b>	<b>92119</b>	<b>88992</b>	<b>82199</b>
<b>E Net-return per animal (D-C)</b>	<b>38420</b>	<b>32795</b>	<b>25528</b>
<b>F Herd size</b>	<b>3.70</b>	<b>9.53</b>	<b>17.75</b>
<b>G Total net returns per farm (E*F)</b>	<b>142154</b>	<b>312536</b>	<b>453122</b>

Figures in parentheses are percentage of total

of dairy unit goes on increasing, in simple words, It is categorical that variable cost per animal is directly proportional to herd size of dairy units, which is ₹46504, ₹49198 and ₹50705 in the case of unit size up to 5, 6-10 and above 10, respectively. The major contributor to this

proportional relationship was share of concentrates expenditure per animal which showed upward trend with increase in herd size. The expenditure on green fodder and dry fodder of one animal goes on decreasing as the herd size increases. Least contributing factor to total variable investment was on insemination charges, followed veterinary services in all herd size categories of dairy units.

However, the trend in case of total fixed cost per animal was in complete contrast to trend followed by total variable cost per animal. The former declined as the herd size was increased and was ₹7195, ₹6999 and ₹5966 in case of unit size up to 5, 6-10 and above 10, respectively. These values revealed the indirectly proportional relationship between total fixed cost per animal and herd size of dairy units. Among the sub factors of total fixed cost per animal, depreciation on animals was the prominent one, with individual share of more than 71 per cent in total fixed cost per animal in almost categories of herd size under study. Another important thing to note here is that contribution of this single factor goes on increasing as the herd size increases *i.e.* 71, 74 and 77 per cent in case of unit size up to 5, 6-10 and above 10, respectively. Depreciation on fodder cutter, electric motor/diesel engine and water structure faced highest proportional decrease with increase in herd size.

The gross returns comprised of sale of milk, sale of young animals, wages earned by cashing family labour and value of dung. The gross returns per animal per year were ₹92119, ₹88992 and ₹82199 in the case of unit size up to 5, 6-10 and above 10, respectively. The highest net returns per animal per year were ₹38420 in the case of herd size up to 5, whereas the same was ₹32795 and ₹25528 in the case of 6-10 and above 10 herd size category, respectively. However, herd size in all these three categories were 3.70, 9.53 and 17.75 was on standard animal unit size up to 5, 6-10 and above 10, respectively and thus overall net returns in these categories was also ₹142154, ₹312536 and ₹453122, respectively.

Thus, dairy farmers having small herd size realized better net returns per animal as compared to counterparts as they can harvest the economies of small scale enterprises like better managerial ability, easy disposal of milk produced etc., but if they consider net profitability from dairy farm as whole, then large herd size is more remunerative.

**Descriptive statistics of dependent and independent variables used in Cobb-Douglas production function**

The perusal of the Table 4 depicts that total returns, which was the dependent variable having ₹per year as its units where as among independent variables, dry fodder, concentrates, animal shed, veterinary expenses were the variables having ₹per year as their units. Herd size was also independent variable and having number of milch animals on dairy farm as unit. Animal type was assigned dummy variables *viz.* 1 for buffalo, 2 for cow and 3 for

**Table 4: Descriptive statistics of dependent and independent variables used in Cobb-Douglas production function**

Particular	Unit	Average
Total returns	₹ per year	351932
Herd size	Number of Milch animals maintained on farm	4.19
Animal type	Dummy variables	Buffalo=1 Cow = 2 Mixed composition = 3
Dry fodder	₹ per year	60254
Concentrates	₹ per year	66140
Animal shed	₹ per year	2763
Veterinary expenses	₹ per year	3935
Education level of dairy person	Dummy variables	Illiterate=1 Primary=2 Metric=3 10+2= 4 Graduation=5 Post graduation=6
Age of dairy person	Years	47

mixed composition.. In the case of educational level of dairy farmers too, dummy variables were assigned *i.e.* 1,2,3,4,5 and 6 for illiterate, primary, metric, 10+2, graduation and post graduation level, respectively.

**Regression coefficients of Cobb-Douglas Function for total returns**

The regression coefficients of explanatory variables included in the model for overall scenario has been depicted in Table 5. It can be seen from the Table that the value of coefficient of multiple determination ( $R^2$ ) came out to be 0.85 showing that 85 per cent of the variation in the model has been explained by the independent variables included in the model. Thus, the included explanatory variables were quite relevant and sufficient.

The regression coefficients of herd size was found to be significant at 1 per cent level of significance which means with the increase in expenditure on this variable by 1 unit the resultant total return increased by 0.716 units. The regression coefficient of cost of animals shed and veterinary expenses were found to be significant at 5 per cent level of significance which means that with the increase in expenditure on these variables by 1 unit the resultant total return increased by 0.089 unit and 0.097 unit, respectively.

Also, the regression coefficient of cost of dry fodder was found to be significant at 5 per cent level of significance but this variable is having negative relation, which means that with the increase in expenditure on dry fodder by 1 unit the resultant total returns would decrease by 0.163 unit.

**Table 5: Regression coefficients of Cobb-Douglas Function for total returns from dairy farm on sample farms, Punjab**

Particulars	Regression coefficients
Intercept	9.266** (0.915)
Herd size	0.716** (0.128)
Animal type	0.045 (0.015)
Dry fodder	-0.163* (0.068)
Concentrates	0.069 (0.046)
Animal shed	0.089* (0.048)
Veterinary expenses	0.097* (0.039)
Education of dairy person	-0.045 (0.038)
Age of dairy person	0.156 (0.091)
R <sup>2</sup>	0.85

“\*\*”, and “\*\*\*” means significant at 5 per cent and 1 per cent, respectively. Figure in the parentheses indicate standard error

### CONCLUSIONS

- The mixed composition of animals in comparison to the only buffaloes or only cows was estimated to be more economically viable.
- In case of single animal type undertaking i.e. either buffaloes or cows only, then former have a

slight higher returns than latter as well as having comparatively lower investment than latter.

- All herd sizes were providing sufficient returns and even the smallest herd size of milch animals up to 5 animals was found to be viable as it provided highest returns per animal per year. The highest gross returns per year were estimated to be from larger herd size.
- Among independent variables herd size, green fodder, animal shed, veterinary expenses and dry fodder came to be significant with total returns.
- Dairy business/enterprises played a significant role in providing employment to people during the slack period.
- Dairy enterprises contributed a considerable proportion to total farm income. Hence, it significantly supplemented the income of resource poor farmers.

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## Adequacy of Green Fodder in Commercial Dairy Farms of Punjab

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### ABSTRACT

The present study was conducted to examine the season wise adequacy status of green fodder in the ration of dairy animals and its underlying effect on milk productivity in the Punjab state. The data, pertaining to the crop year 2014-15 related to fodder and feed management practices from 30 commercial dairy farms formed the basis of the study. The empirical evidence from commercial dairy farms of Punjab, with an average herd size of 83.5 ACUs, brought forth the pronounced use of maize and *berseem* as green fodder. The study brought forth that 60 per cent of the sampled dairy farms had adequate total dry matter intake in all three seasons, 16.6 per cent in two out of the three seasons, while 23.3 per cent were having nutritionally inadequate dry matter intake. As regards the sufficiency status of green fodder, 60 per cent sampled dairy farms were having nutritionally inadequate dry matter intake from green fodder, while 13.3 per cent attained adequacy in this respect in all the three seasons, 16.6 per cent in two seasons and 10 per cent in only one season. This inadequacy, in terms of green fodder norms for high yielders, has not significantly affected the productivity of dairy animals of different breeds in the sampled dairy farms, the plausible reason could be the adequacy in terms of total dry matter intake. The analysis calls for the sensitization of dairy farmers on the use of nutritionally adequate quantity of green fodder for enhancing the milk productivity, which would translate into higher income, a step towards the realization of goal of doubling the farm income by 2022.

### Keywords

Dry matter, green fodder, milk productivity

### JEL Codes

D24, Q12, Q21, C83

### INTRODUCTION

Livestock production is the backbone of Indian agriculture and has been an important source of livelihood in rural areas for centuries. India's livestock sector is one of the largest in the world. It has 56.7 per cent of world's buffaloes, 12.5 per cent cattle, 20.4 per cent small ruminants, 2.4 per cent camel, 1.4 per cent equine, 1.5 per cent pigs and 3.1 per cent of poultry birds. The contribution of milk sector to the total output from livestock is about 68 per cent and in some states it has been recorded as high as more than 80 per cent (Shah *et al.*, 2011).

There has been major shift to diets with increased consumption of animal products, and this change is likely to continue in the coming decades. This shift towards livestock products is going to be more pronounced in case of developing countries and particularly so in the case of India (FAO, 2009). In the event of ever escalating demand

of livestock products and an urgent need to bridge the demand - supply gap, it is being increasingly advocated that future growth in livestock output would have to come from technological breakthroughs in yields. In developing countries, most animals belong to the class, which is typically characterized by lower productivity levels and therefore globally more gains can be generated from large numbers of producers catching up through the application of good feeding and management practices rather than from pushing the frontier for the few high producers using high-tech approaches (Makkar & Ankers, 2014). Since feed and fodder are said to be responsible for improving the productivity by 70 per cent and only 30 per cent improvement comes through genetic research, addressing the issue of feed management deserves utmost importance. Many workers have attempted to quantify animal feed resource availability and requirement (Sen & Ray, 1941; Mudgal & Pradhan,

1988; Hazra and Rekib, 1991; Singh and Mojumdar, 1992; NDRI 1996; Singh *et al.*, 1997).

Fodder plays an important role in economizing the cost of production of livestock products especially of milk. Fodder comprises a major source of protein in dairy ration of milch animals and therefore cultivation of nutritious and high yielding fodder is inevitable. Profitable livestock farming depends mainly on adequate availability of fodder with reasonable price. With increase in number of animal population and shrinking land resources, the problem to provide adequate feed, and forage has become very acute. Common cereal fodder crops like maize, sorghum and oats are rich in energy and the leguminous crops like lucerne, berseem & cowpea are rich in proteins and good source of minerals which are critical for rumen microbes as well as animal digestive system. Apart from that, the green fodder crops are known to be cheaper source of nutrients as compared to concentrates and hence useful in bringing down the cost of feeding and thereby leading to higher profitability. The adequate supply of nutritive fodder and feed is a crucial factor impacting the productivity and performance of the animals.

In the backdrop of this, the present study was therefore envisaged to assess the sufficiency status of green fodder in the dairy animals ration in commercially oriented dairy farms of Punjab and its underlying effect on milk productivity.

#### **MATERIAL AND METHODS**

It was proposed to select a total of 30 commercial peri-urban dairy farms from the selected study area. For the selection of the dairy farms, snow ball sampling technique was used. Snowball sampling technique uses a small pool of initial informants to nominate, through their social networks, other participants who meet the eligibility criteria and could potentially contribute to the specific study. The sampling method in this case commenced with the identification of a dairy farm, whose owner was then asked to suggest other possible participants. These were subsequently interviewed and then asked to propose others. The process continued until the proposed number of dairy farms was selected. The dairy farms thus selected happened to lie within the radius of 12 km from Amritsar City.

The formulation of the study are based on the primary data collected from 30 commercial peri-urban dairy farms selected through snowball sampling technique, lying within the radius of 12 km from Amritsar city well known for Amritsar District Co- operations milk producers' union limited. .

In order to reasonably infer the results, the varied dairy animals were transformed into standard animal units, synonymously know as Adult Cattle Units (ACU). The ACUs were therefore formed as under:

#### **RESULTS AND DISCUSSION**

It is admitted that those dairy farmers who have been most successful are the men who have given not only

**Table 1: Conversion factors for estimating ACUs**

<b>Animal</b>	<b>Age (years)</b>	<b>ACU</b>
Buffalo	> 2.5	1.14
	1-2.5	0.50
	< 1.0	0.17
Cattle	> 2.5	1.00
	1-2.5	0.34
	< 1.0	0.11

*Source: Ramachandran et al. (2007)*

attention to their pastures, but also consideration to the availability of" suitable fodder crops. Forage crops include cereals like maize, sorghum, barley, millet and oat. Other specialized forages include berseem (king of forages), shaftal and lucern. In addition to these forage crops, there are other leguminous forage crops such as cowpea, cluster bean, soybean etc. which are traditionally grown in intercropping systems with forage cereals (Iqbal *et al* 2015). Rice straw is the commonly available and cheapest roughage source for feeding of livestock in India (Prasad *et al.* 2005). The importance of an ample supply of green feed is not denied by any practical dairy farmer. But according to report of the working group on Animal Husbandry and Dairying for the Eleventh Five Year Plan (2007-12), Planning Commission, GOI, there is a huge deficit in the country in green fodder and dry fodder. Over the years, deficit of green and dry fodder is showing upward trend. The deficit of green fodder expected to move up further from 62.76 percent (666 million MT.) in year 2010 to 64.21 percent (759 million MT.) in year 2020.

Availability of good amount of feed and fodder essential for the livestock but quantity of dry matter availability from fodder is of far importance. It was given that overall dry matter availability increased from 385 to 527 million tonnes during 1985-86 to 2004-05, an increase of about 37%. During 2004-05 crop residues contributed 365.8 million tonnes while concentrates and green fodder contributed 34.5 million tonnes and 126.6 million tonnes respectively. And it was also studied that overall dry matter availability has increased from 508 million tonnes in TE 2002/03 to 600 million tonnes in TE 2011/12, an increase of nearly 18 per cent in a period of little less than ten years. In the TE 2011/12, the contribution of dry fodder, green fodder and concentrate to total dry matter availability in India stood at 71.6, 21.2 and 7.2 per cent respectively. It is heartening to note that increase in the dry matter availability (18.1 %) over the study period is much higher than the increase in the livestock population (5.6 %). This can well be attributed as the reason for increase in the milk production at the rate of 52.8 per cent from 81.1 million tonnes in TE 2002/03 to 123.9 million tonnes in TE 2011/12.

The dry matter availability in Punjab has increased from 35.9 million tonnes in TE 2002/03 to 38.9 million tonnes in TE 2011/12, registering an increase of 8.3 percent. In the TE 2011/12, the contribution of dry fodder,

green fodder and concentrate to total dry matter availability in Punjab stood at 84.3, 8.5 and 7.2 per cent respectively as against 71.6, 21.2 and 7.2 observed in case of India. It points towards the paucity of green fodder in Punjab. Punjab's share in green fodder available in the entire Northern Region during TE 2002/03 was 14.2 per cent which decreased to 14 per cent and 13.2 per cent during TE 2006/07 and TE 2011/12 respectively. While Punjab's green fodder share of India was 2.6 per cent remained constant during the three censuses. Punjab has been fortunate enough to corner a share, much higher than its share in livestock population, with respect to all the feed resources.

From the sampled dairy farms it was carried out that out of the average herd size of 87.96, translated into an 83.5 ACUs, buffaloes accounted for 75.2 per cent, crossbred cattle 17.9 per cent and indigenous cattle 6.9 per cent. Out of the total 37.67 in milk buffaloes Murrah dominated with number 29.42 followed by Nilli ravi with 8.24. On the overall basis, an average herd includes 69 female cattle, 1 male and the young stock to the tune of 18. In case of young stocks, the males outnumbered females in case of both the cattle and buffaloes. The herd size as well as the composition remained more or less the same at all times, due to frequent sale/purchase/abandonment. The buffaloes were found to be predominant in all the groups of dairy animals i.e. adult males, adult females and young stock as well.

The ratio of dry to in-milk cattle was observed to be the highest in case of crossbred cattle (1:2.85), closely followed by that in case of buffaloes (1:2.74) and the least (1:1.92) in case of indigenous cattle. The predominance of buffalo in the herd of dairy farms can be attributed to their heat and disease resistant nature. Apart from this efficient utilization of nutrients resulting in higher productivity is another reason for the predominance of buffaloes.

**Feeding practices followed**

Berseem was the most commonly fed fodder crop during winters. The higher protein content, highly

palatable and succulent nature of berseem could be the viable reasons for its popularity. There was only one respondent (3.3%), who was supplementing berseem with lucern. During the rest of seasons, i.e. summer and rainy season, the dairy farmers fed their animals only maize fodder because maize has more dry matter, highly palatable and good source of energy. During rainy season, 96.7 per cent dairy farmers fed maize and only 3.3 per cent dairy farmers fed jowar (sorghum).

**Table 3: Seasonal variations in feeding practices of dairy animals, 2014-15**

Particulars	Winter		Summer		Rainy	
	No.	Per cent	No.	Per cent	No.	Per cent
<b>Green fodder</b>						
Berseem	30	100.0	-	-	-	-
Lucern	1	3.3	-	-	-	-
Jowar	-	-	-	-	1	3.3
Maize	-	-	30	100.0	29	96.7
Bajra	-	-	1	3.3	-	-
<b>Dry fodder</b>						
Wheat straw	30	100.0	30	100.0	30	100.0
Rice straw	4	13.3	3	10.0	1	3.3
<b>Processed fodder</b>						
Silage	2	6.7	-	-	2	6.7
<b>Concentrates</b>						
Homemade feed	30	100.0	30	100.0	30	100.0
Oil cakes	19	63.3	20	66.7	20	66.7
Compound feed	8	26.7	8	26.7	8	26.7

As regards the dry fodder, all the dairy farms were following the practice of feeding wheat straw while 13.3 per cent also fed rice straw to their cattle in winter. The proportion of dairy farmers who feed rice straw decreased in summer and monsoon. Only 6.7 per cent of the dairy farmers used silage as a source of roughage. The silage

**Table 2: Composition of selected dairy farms, 2014-15**

Particular				No./farm
	Cattle		Buffaloes	Overall
	Indigenous	Crossbred		
<b>Adult male</b>	0.23	0.03	0.83	1.09
<b>Adult female</b>	In milk	9.23	37.67	50.17
	Dry	3.27	13.70	18.67
	Total	12.50	51.37	68.84
<b>Young stock</b>	Male	6.17	5.77	13.77
	Female	0.57	2.67	4.27
	Total	7.20	8.44	18.03
<b>Total animals</b>	7.60	19.73	60.63	87.96
<b>ACUs (per cent of total)</b>	5.78 (6.9)	14.95 (17.9)	62.77 (75.2)	83.50

was available in winter and rainy season only. All the sampled dairy farms preferred homemade feed in all the seasons because it costs less and was considered of far better quality than that commercially available. Out of these 63.3 per cent farmers fed oilcake and 26.7 per cent fed compound feed separately during winter.

**Fodder and feed intake**

The availability (on fresh basis) of green fodder per ACU per day in absolute terms was maximum (28.1 kg) in winter, which was followed by that in summer (26.9 kg) and rainy (25.6 kg). Contrary to this, dry matter availability from green fodder during winter ( 4.22 kg per ACU per day) was found to be significantly lower than that observed in summer ( 5.91 kg per ACU per day) and rainy season (5.62 kg per ACU per day) respectively (Table 4). No statistically significant difference was observed during summer and rainy season as far as dry matter from green fodder was concerned.

**Table 4: Seasonal variations in fodder/ feed intake on dry matter basis, 2014-15**

Particulars	kg/ACU/ day		
	Winter	Summer	Rainy
Roughage	10.37	11.21	12.36
Green fodder	4.22 <sup>b</sup>	5.91 <sup>a</sup>	5.62 <sup>a</sup>
Dry fodder	5.57	5.3	6.12
Silage	0.58	-	0.62
Concentrates	3.62	3.49	3.56
Homemade feed	2.77	2.82	2.86
Oil cakes	0.41	0.39	0.42
Compound feed	0.44	0.28	0.28
Total	13.99	14.70	15.92

*\*non significant differences.  
ab figures with different superscripts differ significantly (p<0.05)*

It can be observed from the table that the total dry matter availability per ACU during winter, summer and rainy season per day was 13.99, 14.70 and 15.92 kg respectively, although the differences were non significant. Dry fodder intake on fresh basis per ACU per day was the highest in rainy season with 6.8 kg followed by 6.2 and 5.9 kg in winter and summer respectively. Same trend was shown for dry fodder on dry matter basis had highest during rainy season with 6.12 kg followed by winter and summer with 5.57 and 5.3 kg respectively. The daily silage intake per ACU was nearly the same during winter (1.7 kg) and rainy (1.8 kg) season. The quantity of

homemade feed was maximum in absolute terms (on fresh basis) during monsoon with 3.18 kg per ACU per day and that of oil cake and compound feed was in monsoon and winter respectively with 0.46 and 0.49 kg per ACU per day respectively. Among the concentrates, maximum dry matter availability in absolute terms was during winter with 3.62 kg/ ACU/ day followed by that in rainy and summer with 3.56 and 3.49 kg/ ACU/ day. It needs to be highlighted here that the application of analysis of variance test conclusively established that there were no significant seasonal variations in the intake of any of the feed components.

**Sufficiency Status of Feed Intake**

An effort has been made to draw some inferences on the sufficiency status of the quantity of fodder and feed made available to the dairy cattle of the selected dairy farms by making the comparison with the reference values. The term sufficiency here connotes 'nutritional adequacy' and the norms used here as reference values are for high yielders. The perusal of Table 5 showed that the total dry matter availability per ACU per day on an average was 15.92 kg during rainy season followed by summer and winter with 14.7 and 13.99 kg respectively in comparison to standard reference value of 12.5. But roughage to concentrate ratio observed for all the three seasons, rainy (78:22), summer (76:24) and winter (74:26) was not compatible with the reference value of 60: 40 meant for high producing animals. The average dry matter intake from green in case of sampled dairy animals reported for all the three seasons has been observed to be lower than the reference value of 6 kg (calculated on the basis of 12.5 kg total dry matter intake). The proportion of green fodder in roughage should normatively be 80 per cent, which actually stood at 40.7 per cent in winter, 45.5 per cent in rainy and 52.7 per cent in summer in case of the sampled dairy farms.

In order to overcome the flaw of inferring the results on the basis of averages, an effort has been made to make a comparison of suitable parameters with respect to each farm separately with the reference value. The results obtained there from have been presented in Table 6. By referring to the standard values, it was enumerated that 60 per cent of the sampled dairy farms had adequate total dry matter intake in all three seasons, 16.6 per cent in two out of the three seasons while 23.3 per cent were having nutritionally inadequate dry matter intake. Contrary to this, 60 per cent sampled dairy farms were having nutritionally inadequate dry matter intake from green

**Table 5: Green fodder intake vis-a-vis requirement in selected dairy farms**

	Winter	Summer	Rainy	Reference value
Total DM intake, kg/ACU	13.99	14.7	15.92	12.5
Roughage: Concentrate	R74:C26	R76:C24	R78:C22	R60:C40
Green fodder, kg DM	4.22	5.91	5.62	6
Green fodder, As per cent of roughage	40.7	52.7	45.5	80 per cent

**Table 6: Adequacy of green fodder and total dry matter intake in dairy farms of Punjab, 2014- 15**

Particulars	DM intake adequacy status		Green fodder adequacy	
	No	Per cent	No	Per cent
Adequate				
In all 3 seasons	18	60.0	4	13.3
In 2 seasons	5	16.6	5	16.6
In 1 season	-	-	3	10
Inadequate	7	23.3	18	60.0

fodder, while 13.3 per cent attained adequacy in this respect in all the three seasons, 16.6 per cent in two seasons and 10 per cent in only one season.

**Effect of Adequacy of Green Fodder on Productivity**

In order to ascertain the effect of adequacy of green fodder on milk productivity of different breeds of animals, the dairy farms (and thereby the animals) were classified into two groups, referred to as Group A and Group I hereafter. Group A comprised of 12 dairy farms with adequate green fodder provision and Group I had 18 dairy farms with inadequate green fodder intake (Refer table 6). The average milk productivity of these two groups for different seasons and species/breeds was worked out and subjected to non paired t-test to establish the statistical significance of the difference between the two groups. The corresponding results have been presented in Table 8 with effective sample size mentioned in parenthesis against each group.

**Table 7: Effect of adequacy of green fodder on productivity (litres/d) status of dairy animals of Punjab, 2014- 15**

Particulars	Productivity, litres/day		
	Winter	Summer	Rainy
<b>Cows Crossbred</b>			
Group A (n=11)	25.91	15.91	14.27
Group I (n=8)	23.63	15.75	14.50
Difference	2.28 <sup>NS</sup>	0.16 <sup>NS</sup>	-0.23 <sup>NS</sup>
<b>Cows Indigenious</b>			
Group A (n=8)	14.13	11.88	11.75
Group I (n=13)	12.46	11.00	10.85
Difference	1.66 <sup>NS</sup>	0.88 <sup>NS</sup>	0.90 <sup>NS</sup>
<b>Buffalo Murrah</b>			
Group A (n=9)	15.00	12.89	12.67
Group I (n=18)	15.06	13.11	12.78
Difference	-0.06 <sup>NS</sup>	-0.22 <sup>NS</sup>	-0.11 <sup>NS</sup>
<b>Buffalo Nili Ravi</b>			
Group A (n=5)	14.00	11.80	11.80
Group I (n=11)	13.45	11.64	11.73
Difference	0.55 <sup>NS</sup>	0.16 <sup>NS</sup>	0.07 <sup>NS</sup>

In case of crossbred cattle, milk productivity of Group A (25.91 kg/ ACU/day) was higher than that of Group I (23.63 kg/ACU/day) during winter season but statistically the difference was not significant. Similar was the case during summer and rainy season values. In case of indigenous cattle, average yield of Group A was a little higher in absolute terms than that of Group I in winter (14.13 vs 12.46) , summer (11.88 vs 11.00) and rainy (11.75 vs 10.85) but the differences were found to be non significant. In spite of higher productivity in absolute terms observed in case of Group A than that in Group I of Nilli Ravi breed of buffalo, statistically there was no difference. The inadequacy in terms of green fodder norms for high yielders has not significantly affected the productivity of dairy animals of different breeds in the sampled dairy farms, the plausible reason could be the adequacy in terms of total dry matter intake.

**CONCLUSION**

It needs to be highlighted that notwithstanding the considerable variation existing in the availability of feed resources across different regions of the country, the state of Punjab is fortunate to have fairly good share in the total dry matter availability. The proportion of green fodder, dry fodder and concentrates in total dry matter availability observed in case of Punjab does point towards the paucity of green fodder in the area and this has been reflected in nutritionally inadequate dry matter intake from green fodder in case of majority of the farms. Although the feed resources available are sufficient to meet the dry matter requirement, meeting the energy and protein requirement remains a challenge under the current scenario. This calls for the sensitization of dairy farmers on the use of nutritionally adequate quantity of green fodder for enhancing the milk productivity.

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## Water Resource Usage Patterns for Strategic Crop Production

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### ABSTRACT

Irrigation water is a basic requirement of crop production. It was reported that during 2010-11 out of 398.16, 20.32, and 1.23 BCM total net ground water availability; 222.36, 34.17 and 2.17 BCM water was used for irrigation respectively in India, Punjab and Amritsar district. The major share of available water was used for irrigation (90 to 98 per cent). In the crop production sector, 43.56 per cent of total grossed cropped area was under rice crop but it used 80.02 per cent share of the total irrigation water in district Amritsar during 2010-11. It was estimated that under current groundwater development and crop production situation in the district the breakeven point for available water for paddy crop was 566.84 MCM. Therefore there is an urgent need to strategically reduce the water use share for paddy crop from 80.02 to 47.92 per cent of the total available irrigation water in the district.

### Keywords

Ground water, paddy, water resources, water-use efficiency

### JEL Codes

O13, O39, Q16, Q54

### INTRODUCTION

Natural water resources and its sustainable development are essential to determine the well being of agricultural economy. It was recognized that serious and sincere measures are required to conserve the water resources in terms of both quantity and quality (Unnikrishnan, 2016). Groundwater comprises 97 percent of the world readily accessible fresh water and it provides the rural, urban, industrial and irrigation water supply needs to 2 billion people around the world (Garduno *et al.*, 2011). India has a vast coastline, but the saline water is not suitable for agriculture and industrialization; so groundwater is the primary source for both industrialization and agriculture. Agriculture plays a major role in India's economy and irrigation is dependent on groundwater (Sena & Nagwani, 2016). Increase in the farming income is on the high agenda of policy makers in India and rice contributes a lot to the Indian economy as well as the economy of the Punjab state. Irrigation water is a basic requirement of crop production. India has the largest area (23.3 per cent of gross cropped area of the country) under rice crop which requires high amount of water. Studies reported that

percolation during land preparation accounted for up to 40 per cent of the total water supplied for growing of rice crop (Tuong, 1999). The excessive use of water in rice cultivation in Northwest Indo Gangetic Plains is depleting aquifers. The excessive and irrational use of underground water in Punjab has led to depletion of water table, soil quality along with other environmental problems. The wheat-rice rotation, groundwater use, procurement policy and electricity policy have vicious relationship that is economically and ecologically unsustainable (Sarkar & Das, 2014). The groundwater level data has shown that the maximum decline to the tune of 9.75 m was found in Patiala, followed by 8.57 m in Bhatinda and least decline of 3.13 m was found in Jalandhar during the period 2006-2013 (Krishna *et al.*, 2014). In light of the above scenario the present study has been undertaken for optimum utilization of ground water resources of district Amritsar.

### METHODOLOGY

Primary as well as secondary data were used to estimate the patterns of water use for crop production in district Amritsar. Primary data were collected from the randomly selected 100 farmers on the selected four villages of the district. Out of the total nine blocks, four

blocks were selected randomly and one village was randomly selected from each block i.e. Bhorshi Rajputan (Rayya), Thathian (Jandiala Guru), Dairywal (Tarsikka) and Rajatal (Attari). A representative randomly selected 100 farmers sample was selected based on average operational holdings of the district (Table 1). Primary data were collected from the farmers through personal interview method. The data related to number of irrigation applied for various crops in the year 2010-11 was recorded. Heavy (8 cm), medium (7 cm) and light (6 cm) irrigations were classified from farmers to know the depth of irrigation water. Tabulated data was used to compute the average irrigations and water quantity used for the irrigations. The actual area under each crop was taken from secondary data for estimates. Therefore total water used for each crop was calculated through multiplication of its area with average use of number of irrigations and its water quantity applied to the respective crops. An effort was made to know the breakeven point of available water for paddy crop under current water use patterns of the district.

## RESULTS AND DISCUSSIONS

### Cropping Pattern and Paddy Cultivation

Paddy was cultivated in 1183 thousand ha in Punjab during the year 1980-81 and as a shift towards paddy-wheat crop over time and the Paddy-wheat rotation dominate the cropping pattern of Punjab. Out of total grossed cropped area in district Amritsar there was 40.22 per cent area under paddy-wheat rotation during 1960-61

**Table 1: Sample size and operational holdings in Amritsar district of Punjab (2010-11)**

Farm size (in hectares)	Selected sample farms (No.)	Per cent operational holdings in the district (census data)
Marginal (up to 1 )	12	12.41
Small (1-2)	24	24.18
Semi medium (2-4)	36	37.24
Medium (4-10)	24	22.77
Large (10 and more)	4	3.41
Total	100	100.00

which was increased to 87.82 per cent during 2010-11. It is clear from Table 2 and 3 that as a result of this shift the area under maize, oilseeds, pulses, fodders and horticultural crops was decreased over the period. The share of Paddy crop in the Gross Cropped Area of the district was increased from 9.21 per cent to 43.56 per cent from 1960-61 to 2010-11. The area under maize crop in the district was 22 thousand hectares during 1950-51 which increased to 45 thousand hectares during 1970-71 and then the area under maize crop was decreased over time and it was only one thousand hectares during 2010-11. Rice productivity was 1448 kg/ha during 1960-61 which increased to 4911kg/ha during 2015-16 in district Amritsar (Table 4). The increase in the productivity of paddy crop over the years was due to the technology improvements and excessive use of ground water for

**Table 2: Shift in area under different crops in district Amritsar**

Crop\Year	(000' ha)					
	1960-61	1970-71	1980-81	1990-91	2000-01	2010-11
Rice	41	89	196	277	319	186
Wheat	138	242	298	355	361	189
Maize	33	45	19	11	5	1
Sugarcane	13	11	6	5	11	3
Rape seed & Mustard	12	32	24	11	4	1
Sun Flower	-	-	1	1	0.3	0.2
Other crops	208	168	149	118	118.7	46.8
Gross cropped area	445	587	693	778	819	427

Source: Statistical Abstracts Punjab

**Table 3: Per cent shift in area under different crops in district Amritsar**

Crop\Year	(000' ha)					
	1960-61	1970-71	1980-81	1990-91	2000-01	2010-11
Rice	9.21	15.16	28.28	35.60	38.95	43.56
Wheat	31.01	41.23	43.00	45.63	44.08	44.26
Maize	7.42	7.67	2.74	1.41	0.61	0.23
Sugarcane	2.92	1.87	0.87	0.64	1.34	0.70
Rape seed & Mustard	2.70	5.45	3.46	1.41	0.49	0.23
Sun Flower	0.00	0.00	0.14	0.13	0.04	0.05
Other crops	46.74	28.62	21.50	15.17	14.49	10.96
Gross cropped area	100.00	100.00	100.00	100.00	100.00	100.00

**Table 4: Year wise area and productivity of rice in district Amritsar**

Year	Area (000 ha)	Yield (Kg/ha)	Production (000MT)
1950-51	28	1546	43
1960-61	41	1448	67
1970-71	89	1953	174
1980-81	196	1774	348
1990-91	277	2754	763
2001-02	319	3003	958
2002-03	311	2826	879
2003-04	326	2675	872
2004-05	334	3095	1034
2005-06	345	2907	1003
2006-07	178	3024	538
2007-08	179	3064	548
2008-09	183	2907	532
2009-10	185	2706	501
2010-11	186	2705	503
2011-12	186	2816	523
2012-13	187	2893	540
2013-14	182	4840	881
2014-15	180	4627	833
2015-16	181	4911	884

Source: Statistical Abstracts of Punjab

irrigations.

#### Water Resources and Ground Water Development

The ground water pattern in India, Punjab as well as in district Amritsar is being depicted in Table 5. It was reported that 432.72 BCM total annual replenish able ground water resources were present in India during 2010-11. Out of it during monsoon season, recharge of 58.36 per cent was contributed by rain fall and 15.96 per

cent from other sources in India. In contrast with India the monsoon season rain fall recharge was 25.83 per cent in Punjab and 23.21 per cent in district Amritsar. The total monsoon recharge falls between 73 to 77 per cent of total annual replenish able ground water resources in India, Punjab as well in district Amritsar. The monsoon recharge from other sources were 47.23 and 53.36 per cent in Punjab and in district Amritsar respectively. Therefore the availability of groundwater recharge in Punjab as well as in district Amritsar is dependent on total monsoon rain fall in India as compared to the net rain fall in the region. The net ground water availability was 398.16, 20.32 and 1.23 BCM in India, Punjab and district Amritsar respectively. The total ground water draft was 245.5, 34.88 and 2.22 BCM in India, Punjab and district Amritsar respectively. As a result of it during 2011 the stage of ground water development was 62, 172 and 180 per cent in India, Punjab and district Amritsar respectively. Therefore over exploited situation of ground water was observed in Punjab as compared to India. The situation of ground water development was worse in district Amritsar as compared to the state of Punjab. Out of the total ground water draft 90.74, 97.96 and 97.75 per cent was used for irrigations of crop production in India, Punjab and district Amritsar respectively. Therefore augmentation of irrigation water for crop production is most important for efficient use of water resources in the country as well as in district Amritsar. With the increase in further water use for irrigation purposes will worsen the ground water situation in the district and Punjab as there is an increase in projected water demand for domestic and industrial use (Table 5).

#### Water Use Pattern for Crop Production

The 78 per cent area in Amritsar district of Punjab was covered by tube wells and 22 per cent major canal for

**Table 5: Ground water patterns in India, Punjab and district Amritsar (2011) (BCM)**

Sr. No.	Particulars	India	Punjab	Amritsar
<b>1</b>	<b>Annual replenish able ground water resources</b>			
a	Monsoon season recharge from rainfall	252.53	5.82	0.318
b	Monsoon season recharge from other sources	69.06	10.64	0.731
c	Non monsoon season recharge from rainfall	40.63	1.33	0.084
d	Non monsoon season recharge from other sources	70.48	4.74	0.237
e	<b>Total annual replenish able ground water resources</b>	<b>432.72</b>	<b>22.53</b>	<b>1.37</b>
<b>2</b>	<b>Natural discharge during non monsoon period</b>	<b>34.6</b>	<b>2.21</b>	<b>1.37</b>
<b>3</b>	<b>Net ground water availability</b>	<b>398.16</b>	<b>20.32</b>	<b>1.234</b>
<b>4</b>	<b>Annual ground water draft</b>			
a	Irrigation	222.36	34.17	2.171
b	Domestic and industrial water supply	22.71	0.71	0.05
c	Total annual ground water draft	245.05	34.88	2.221
<b>5</b>	<b>Projected demand for domestic and industrial uses up to 2025</b>	<b>32.34</b>	<b>0.98</b>	<b>0.078</b>
<b>6</b>	<b>Net ground water availability for future irrigation use</b>	<b>154.71</b>	<b>-14.83</b>	<b>-1.016</b>
<b>7</b>	<b>Stage of ground water development (per cent)</b>	<b>62</b>	<b>172</b>	<b>180</b>

Source: Anonymous (2013; 2014)

irrigation. The 72139 total number of tube wells was observed in the district Amritsar during 2006-07 censuses. The prevailing method of irrigation for crop production in the district is through flood irrigation. Out of gross cropped area of 427 thousand ha in district Amritsar, 186 thousand ha was under paddy crop during 2010-11. Average number of irrigations for various crops and its quantum based on heavy (8 cm), medium (7 cm) and light (6 cm) was calculated from survey data of 100 farmers selected through systematic random sampling (Table 6). Based on simple mathematical calculation of irrigation data of sample survey and area compiled from Statistical Abstract Punjab it was estimated that 4168 thousand irrigations were applied on the 427 thousand ha cropped area of district Amritsar. Therefore it was observed in the study that 2468.25 MCM water was used for paddy cultivation in district Amritsar (Table 7) which was 80.02 per cent of the total irrigation water used by the crops. For the same period, 13.83 per cent (426.44 MCM) water was used for wheat production, followed by other crops 4.80 per cent (147.95 MCM) and 1.21 per cent (37.41 MCM) by sugarcane. The total estimated water used for crop production was 3084.42 MCM during 2010-11 in district Amritsar. It was reported by the Central Ground Water Board (Table 5) that ground water

**Table 6: Number of irrigations and approximate water used for crop production on sample farms**

Crop	Average irrigations (No.)	Average irrigations depth (cm)
Rice	17.67	7.51
Wheat	3.27	6.90
Maize	4.13	7.11
Sugarcane	16.63	7.50
Rape seed & mustard	1.33	6.67
Sun flower	3.80	7.20
Other crops	4.44	7.12

development stage in district Amritsar was 180 per cent. Therefore breakeven point for available irrigation water was 1183 MCM after meeting the domestic and industrial water supply of 50 MCM and considering net ground water availability of 1234 MCM in district Amritsar. Breakeven point for paddy cultivation was estimated and depicted in Table 8.

It was estimated under current crop production system that after meeting the water requirement of all other crops in district Amritsar 566.84 MCM water is available for paddy cultivation. Therefore there is an urgent need to

**Table 7: Estimated water used for crop production in district Amritsar (2010-11)**

Crop	Area (00 ha)	Average irrigations per ha (No.)	Total irrigations estimated (000')	Estimated irrigations depth (cm)	Estimated water used (MCM)	Estimated water used (BCM)	Per cent of water used
Rice	186	17.67	3286.62	7.51	2468.25	2.47	80.02
Wheat	189	3.27	618.03	6.90	426.44	0.43	13.83
Maize	1	4.13	4.13	7.11	2.93	0.00	0.10
Sugarcane	3	16.63	49.88	7.50	37.41	0.04	1.21
Rape seed & mustard	1	1.33	1.33	6.67	0.89	0.00	0.03
Sun flower	0.2	3.80	0.76	7.20	0.55	0.00	0.02
Other crops	46.8	4.44	207.79	7.12	147.95	0.15	4.80
Total	427	9.76	4168.54	7.40	3084.42	3.08	100.00

Source: Area compiled from Statistical Abstract Punjab and average number of irrigations and depth of irrigation calculated from the sample survey

**Table 8: Breakeven point of paddy for current crop production situation in district Amritsar**

Crop	Area (00 ha)	Average irrigations per ha (No.)	Total irrigations estimated (00 No.)	Estimated irrigations depth (cm)	Estimated water used (MCM)	Estimated water used (BCM)	Per cent of water used
Rice	43	17.67	754.77	7.51	566.84	0.57	47.92
Wheat	189	3.27	618.03	6.90	426.44	0.43	36.05
Maize	1	4.13	4.13	7.11	2.93	0.00	0.25
Sugarcane	3	16.63	49.88	7.50	37.41	0.04	3.16
Rape seed & mustard	1	1.33	1.33	6.67	0.89	0.00	0.08
Sun flower	0.2	3.80	0.76	7.20	0.55	0.00	0.05
Other crops	46.8	4.44	207.79	7.12	147.95	0.15	12.51
Total	284	5.77	1636.69	7.23	1183.00	1.18	100.00

Source: Compiled from Table 7

decrease the irrigation water share of paddy crop from 80.02 to 47.92 per cent in total water used for crop production in district Amritsar. As a result under current crop scenario water was available for 43 thousand ha rice crop against the existing 186 thousand ha area under the crop.

## CONCLUSIONS

Paddy and wheat rotation dominate the cropping pattern of Punjab as well as in district Amritsar. The share of Paddy crop in the Gross Cropped Area in Amritsar district was increased from 9.21 per cent to 43.56 per cent from 1960-61 to 2010-11. The Central Ground Water Board reported that 432.72 BCM total annual replenish able ground water resources were present in India during 2010-11. Out of it during monsoon season, recharge of 58.36 per cent was contributed by rain fall and 15.96 per cent from other sources in India. In contrast with India the monsoon season rain fall recharge was 25.83 per cent in Punjab and 23.21 per cent in district Amritsar. The total monsoon recharge falls between 73 to 77 per cent of total annual replenish able ground water resources in India, Punjab as well as in district Amritsar. The monsoon recharge from other sources were 47.23 and 53.36 per cent in Punjab and in district Amritsar respectively. Therefore the availability of groundwater recharge in Punjab as well as in district Amritsar is more dependent on total monsoon rain fall in India as compared to the net rain fall in the respective area. The net ground water availability was 398.16, 20.32 and 1.23 BCM in India, Punjab and district Amritsar respectively. The total ground water draft was 245.5, 34.88 and 2.22 BCM in India, Punjab and district Amritsar respectively. As a result of it during 2011 the stage of ground water development was 62, 172 and 180 per cent in India, Punjab and district Amritsar respectively. Therefore over exploited situation of ground water was observed in Punjab as compared to India and the situation of ground water development was worse in district Amritsar. Out of the total ground water draft 90.74, 97.96 and 97.75 per cent was used for irrigations of crop production in India, Punjab and district Amritsar respectively. Therefore augmentation of irrigation water for crop production is most important for efficient use of water resources in the country as well as in district Amritsar. With the further increase in water utilization for crop production in Punjab as well as in Amritsar district will worsen the ground water situation.

It was noticed that 78 per cent area in Amritsar district of Punjab was covered by tube wells and 22 per cent major canal. The 72139 total number of tube wells was observed in the district Amritsar during 2006-07 censuses. The prevailing method of irrigation for crop production in the district is through flood irrigation. Out of gross cropped area of 427 thousand ha in district Amritsar, 186 thousand ha was under paddy crop during 2010-11. Therefore it was observed in the study that 2468.25 MCM water was used for paddy cultivation in district Amritsar (table 7) which

was 80.02 per cent of the total irrigation water used by the crops. The total estimated water used for crop production was 3084.42 MCM during 2010-11 in district Amritsar. The breakeven point for irrigation is 1183 MCM after meeting the domestic and industrial water supply of 50 MCM at net ground water availability of 1234 MCM in district Amritsar. Breakeven point of available water for paddy cultivation was 566.84 MCM in district Amritsar. Therefore there is an urgent need to decrease the irrigation water share of paddy crop from 80.02 to 47.92 per cent in total water used for crop production in district Amritsar. Under breakeven scenario water was available for 43 thousand ha rice crop against the existing 186 thousand ha area in the district. Therefore there is an urgent need to save almost half irrigation water over existing practices for paddy cultivation through innovative advance technology. The economically explored water saving techniques should be adopted. Another strategy is to switch over the paddy area to next best alternative crops having annual water requirement of 1234 MCM in district Amritsar.

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## Gamification: The Next Growth Story

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### ABSTRACT

Gamification is used by brands to motivate employees, create healthy competition among teams, generate buzz or social proof, and encourage customer loyalty, among other benefits. With a variety of techniques – some easy to implement, some requiring advanced planning, coding, or technical expertise – any business can use gamification to get better results, no matter what your goals. By harnessing the entertaining aspects of games, gamification technology offers organizations a solution to their engagement problems. In many of its initial applications, gamification has had impressive results, leading global organizations. It is one of the leading concept which is growing at a fast pace.

### Key Words

Big data, game mechanics, gamification

### JEL Codes

L81, M31, M37

### INTRODUCTION

To describe gamification lets begin with an example given below of Eye-spy pretzel by M&M's. They introduced this game as a part of its Pretzel marketing campaign. It was based on the eye-spy logic, where users on Facebook were given scattered M&M's in a large image and were asked to detect one small pretzel inside. The design and thought-process of the game was inexpensive, but it quickly went viral and brought great results for the company in terms of engagement, shares, and willingness of people to buy the Pretzel brand.

The result seen was that over 26,000 likes, 6200 shares and 11,000 comments. Not bad for something this simple. The campaign also received praise from all over. The learning outcome is the design of the content could be simple, but the gamified context should motivate consumers to participate. Use images in your campaign that function as a game. Keep the game related to your product/brand, as well as relevant to your target audience.

#### What is gamification?

Gamification is the concept of applying game mechanics and game design techniques to engage and motivate people to achieve their goals (Kapp *et al.*, 2013).

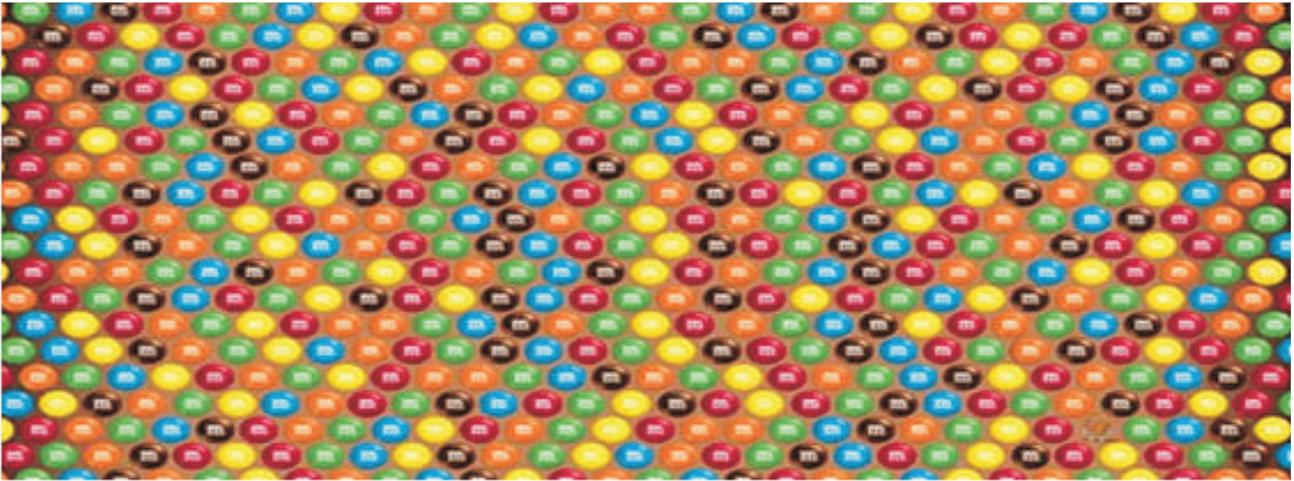
#### Big Data and Gamification

It is a powerful tool for motivating better

performance, driving business results, and generating a competitive advantage. By capturing and analyzing the big data on behaviors, businesses can create a more engaging experience that motivates employees and users. 71 per cent of companies expect big data to have a significant impact on sales (Zeiramann & Cunningham, 2012). By providing extensive insight into user behavior, big data can indicate what activities, content types, and frequencies are yielding the best results. It also allows companies to adapt to various user behaviors and motivations. In order to get the most value out of gamification it is important to go beyond the data and try to understand not only how the users are behaving but also to ask 'why', and also come up with creative ideas to improve the system. Effectively using data analytics and gamification, in turn, helps businesses sell more and increase customer loyalty.

#### Games versus Gamification

When people hear gamification, they envision games created for a business purpose. But gamification is not about creating something new. It is about amplifying the effect of an existing, core experience by applying the motivational techniques that make games so engaging. When you increase high-value interactions with customers, employees, and partners, you drive more



sales, stronger collaboration, better ROI, deeper loyalty, higher customer satisfaction and more (Herger, 2014).

### Game Mechanics

Gamification is built upon 10 primary game mechanics, proven to motivate and engage users, and may use any combination of these techniques to accomplish business goals (Hugos, 2012).

1. Fast Feedback: Immediate feedback or response to actions
2. Encourage users to continue or adjust their activities with onscreen notifications, text messages or emails. Congratulate a user for reaching a goal, encourage the next step to a milestone or promote a new reward.
3. Transparency: Where everyone stands
4. Show users exactly where they stand on the metrics that matter to you and to your audience. Individual and team profiles show progress in real-time and historically. Leaderboards show who's just ahead and who's behind as well as overall ranking on any number of metrics.
5. Goals: Short- and long-term goals to achieve
6. Missions or challenges give users a purpose for interaction, and educate users about what is valued and possible within the experience.
7. Badges: Evidence of accomplishments
8. An indicator of accomplishment or mastery of a skill is especially meaningful within a community that understands its value. Often used to identify skills and expertise within a group.
9. Leveling Up: Status within my community
10. Levels indicate long-term or sustained achievement. Used to identify status within a community and to unlock new missions, badges, activities, and rewards.
11. Onboarding: An engaging and compelling way to learn
12. Video games train you how to play as you play – users learn by doing. Simple missions help new users become engaged immediately as they

master basic tasks, rather than being stumped by an unfamiliar interface or a detailed manual.

13. Competition: How I'm doing compared to others
14. Raise the stakes for accomplishing a goal by showing users how they compare to others, as individuals or in teams. Encourage competition with time-based, team and individualized leaderboards. Where do I rank? How can I overtake my closest competitor?
15. Collaboration: Accomplish a goal working with others
16. Connect users as a team to accomplish larger tasks, to drive competition, and to encourage knowledge sharing. Show team members how they are contributing to the group's success. No one wants to let down their team members.
17. Community: A context for achievement
18. Community gives meaning to goals, badges, competitions, and other mechanics. Sharing participant achievements creates energy in the community by making people aware of what others are doing. They learn about goals, badges, and rewards that they may want to pursue.
19. Points: Tangible, measurable evidence of my accomplishments
20. Used to keep score and establish status or accumulated to purchase virtual or real goods. Earn points through activities, sharing, contributing, or by creating something useful to others.

### The Promise of Gamification

Gamification is transforming business models by creating new ways to extend relationships, craft longer-term engagement, and drive customer and employee loyalty. It works because it leverages the motivations and desires that exist in all of us for community, feedback, achievement and reward. When combined with the latest research on motivation and the big data generated by user interactions, gamification empowers businesses to create true loyalty.

## **Top Gamification Statistics and Facts Expected Market Growth**

Gamification seems to progressively appear also at corporate training environments, as stakeholders are now recognizing the importance of gamification for training purposes, given that games may offer employees the opportunity to acquire and cultivate skill sets, while empowering them and putting them in control of their own eLearning experience via increased engagement. The market growth of gamification is expected to reach the \$1,707 billion in 2015 and the 5,500 billion in 2018. The biggest market is expected to be the North America, followed by Europe. (Gartner & Deterding, 2015).

### **Current and Expected Generated Revenue**

Game-based global revenue in 2012 was \$1,548 million, and with a five year CAGR of 8.3per cent, this revenue is expected to reach \$2,309 million in 2017.

Simulation-based global revenue in 2012 was \$2,364 million, and with a five year CAGR of 23 per cent, this revenue is expected to reach \$6,648 million in 2017.

The total global revenue in the learning games market in 2012 was \$3,912 million and with a five year CAGR of 18 per cent, this revenue is expected to reach \$8,958 million in 2017 (Anonymous, 2012).

### **Expected Corporate Demand**

Based on the findings of a survey conducted by Talent LMS (2013), 79per cent of the participants (both corporate learners and university students) said that they would be more productive and motivated if their learning environment was more like a game.

Gartner Research has predicted that by the year 2015, more than 50per cent of corporate processes will be gamified.

In addition, gamification will be the primary mechanism that 40per cent of the Global 1000 organizations will employ to improve their business operations.

### **THE CHALLENGES**

The need for ongoing training is something we are all aware of in a world of constant change and disruption in business. Organisations that cannot or will not keep up fail and staff know it. The costs of training are not just the bought in costs or the time of the trainer, sales people sitting in a classroom are not selling, fee earners are not earning. And distributed organisations may have to fly people in from around the world for training. This is where you can turn peoples obsession with playing games on their phone to your advantage. Did you know 93 million people play Candy Crush every day (not you or us of course)• (Gartner & Deterding, 2015) People just love competing with others to top leader boards, reach new levels and win prizes – even if the prizes have no actual value. You can use this obsession with mobile phones and gaming to train and engage people and maximise the return on your investment in other forms of training

### **Why Gamification Works: The Mechanics**

Remember your first paycheck• It was pretty exciting

and felt awesome. Today, you probably make more money, but you don't get as excited about it.

That's because it's the same stimulus over and over again. Every type of reward will need to increase in intensity over time due to habituation, which is part of the behavior of economics (Zichermann, 2010).

### **THIS IS HOW IT WORKS**

People have their phones with them all the time and are willing to download Apps. So you don't have to invest in hardware. And if your App is showing alerts they will open it and if someone else has overtaken them in a leader board or won a prize they will go in and complete a module or a test to get their score up.

Better still, they are likely to start collaborating, asking one another questions, sharing hints and tips and generally getting engaged with the training content, their colleagues and the organisation. Often this is a way to maximise your investment in face-to-face training but with care you can introduce new concepts, update training and create new modules to build on existing training. And that's just the start. (Fuchs *et al.*, 2014). You can add Chat, Sharing, Newsfeed and reporting functions to add more to the engagement and communication. Users begin to create their own content bringing the whole community a life of it's own.

### **MUCH MORE THAN A LEARNING MANAGEMENT SYSTEM**

Apps on mobile phones produce better results as far as engagement, communication and collaboration are concerned. They are certainly better for people who are working away from the office, like sales teams, and people will use them when they have a little down time, like coffee breaks or train journeys.

It's widely recognised that engagement increases productivity so the business case for improving engagement and maximising on investment in training is hard to argue against.

### **Gamification Career Opportunities**

How do you build a career in gamification• (Burke 2014). Below is the list he put together on what he sees as the top career opportunities within the emerging gamification job market:

- Gamification Design Consultant
- Gamification Project Manager
- Business Process Analyst/Engineer
- Product Manager/Designer

As companies grow, according to Burke, they will need to have a Chief Engagement Officer or someone inside the organization, likely from IT, who is responsible for knowing how to engage both employees and customers.

### **CONCLUSIONS**

According to a recent study by Research and Markets, the global gamification market will grow to \$11.1 billion by 2020. With such a huge market and a wide variety of solutions, it can be difficult for first-time buyers to make the right decision (Kapp *et al.*, 2013). When you

increase high-value interactions with customers, employees, and partners, you drive more sales, stronger collaboration, better ROI, deeper loyalty, higher customer satisfaction and more. a change in corporate culture stemming from a different understanding about what motivates employees and how to motivate them. This isn't a culture of "fun video games" as could be argued in 2012, it is a culture that views the alignment of goals between employee and employer with a new way of thinking Shiralkar & Shreekant (2016). The research company Gartner predicts that by 2015, a gamified service for consumer goods marketing and customer retention will become as important as Facebook, eBay, or Amazon, and more than 70 per cent of Global 2000 organizations will have at least one gamified application.

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## **Impact of National Food Security Mission-Pulses on State-wise Area Production and Yield Trends in India**

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### **ABSTRACT**

*To cease stagnation in production of pulses in India, various initiatives have been undertaken by government periodically over five decades. Among various initiatives, National Food Security Mission (NFSM) - Pulses was launched in 2007-08 to strengthen production base of pulses in India. The present study is an attempt to evaluate the impact of NFSM-Pulses on state-wise area, production and yield in India. Growth rate was estimated for different periods and compared with period after start of NFSM-Pulses to evaluate the growth impact on area, production and yield in different states. The study revealed that significant growth in area and production was observed in Punjab, Bihar, West Bengal Madhya Pradesh post NFSM-Pulses initiation. The yield performance after NFSM-Pulses initiation increased in all the states of eastern zones along with significant increase in Karnataka and Gujarat. The study also emphasized on exploiting production potential of pulses in niche states like Karnataka, Tamil Nadu and Gujarat by further strengthening of NFSM-Pulses program.*

### **Key words**

Growth impact, NFSM-Pulses, yield performance

### **JEL Codes**

C81, O13, Q18

### **INTRODUCTION**

Pulses are an integral part of Indian diet after cereals and furthermore, with more than 30 per cent of the total Indian population are vegetarian, pulses are ideal food to ensure adequate intake of protein, minerals, fibers and various amino acid. Along with nutritional benefits, pulses are also the most sustainable crop utilizing less water as compare with other crops, restore soil fertility and also play an important role in crop diversification. Despite of nutritional and agronomical advantages, the major constraints in pulses cultivation in India are high risk of crop failure, low and unstable yield, low price of produce and lack of institutional and policy support to farmers.

India produces an average of 17.55 million tonnes of pulses from 23.55 million hectares accounting for over one-third of world's total area and 20 per cent of total world production. In spite of being the world's largest producers of pulses, India has never achieved self-sufficiency in production, resultant; additional requirement has to be fulfilled by importing from other

countries in expense of foreign currency. On the contrary, little surplus is available in global stock for supply hence it is imperative to increase domestic production. In order to achieve self-sufficiency in production, the Government of India has launched various mission, schemes and programs like National Pulses Development Programme, Technology Mission on Pulses and recently National Food Security Mission (NFSM) on Pulses. According to NFSM-Pulses, government has target to cover the pulses area of one million hectare of 8 million hectare rice fallow land in next three years in the eastern states to increase the production (Anonymous, 2016). For the long term production sustainability in India, hidden potential of minor states in pulses production should be explored by identifying region specific constraints, necessary infrastructure and efficient execution of pulses development scheme as suggested by Srivastava *et al.* (2010). Apart from area expansion, Government of India has been emphasizing on improvement in yield and thereby increment in production. Various efforts under National Food Security Mission- Pulses such as

distribution of certified seeds of pulses, front line demonstration to popularize improve varieties/ technology to the farmer for varietal diversification, supply of micronutrients to induce productivity in the country (Anonymous, 2016a).

Joshi *et al.* (2016) suggested that to increase pulses area and intensify production, assured irrigation should be given priority in pulse-producing areas. Increase in expected price that covers the risk premium, increasing Minimum Support Price (MSP) substantially from the current level, investing in research and extension, aggregating pulse growers into farmer producer organization, and paying pulses growers for the ecosystem services offered by pulses will make pulses affordable to the consumers and also benefit all the stakeholders involved including ecosystem as a whole.

In this context, the objectives of this study are (a) to understand the state-wise share of area, production and yield of total pulses in India, (b) to study the trends of area, production and yield of total pulses in India, and (c) to study the impact of NFSM-Pulses in area, production and yield of total pulses in India.

#### METHODOLOGY

The present study has been approached using (a) simple tabular method and (b) statistical technique. This study is mainly based on secondary time series data drawn from Indian Institute of Pulses Research, Ministry of Agriculture and Department of Agriculture. Data were collected for the major pulses producing states of India. The major pulses growing states were decided as per their contribution of more than 80 per cent share of area and production.

The Overall Period (1970-71 to 2014-15) was divided into three sub-periods, as Period-I (1970-71 to 1989-90), Period-II (1990-91 to 2007-08), Period-III (2008-09 to 2014-15) and Overall Period (1970-71 to 2014-15). The periods were categorized on the following base, pre-Special Food Grain Production Program (SFGPP) (1970-71 to 1989-90), Post- SFGPP (1990-91 to 2007-08) and period after initiation of National Food Security Mission-Pulses (Anonymous, 2016b).

In order to capture the regular trends, the states which were bifurcated after 1970-71 were merged with the parent states. Hence area, production and yield of Chhattisgarh, Uttarakhand, Jharkhand, and Telangana were combined to Madhya Pradesh, Uttar Pradesh, Bihar and Andhra Pradesh respectively.

The compound growth was estimated by following procedure-

$$Y_t = AB^t$$

Where,

$Y_t$  = area / production / yield of state concerned in the year t.

A = intercept

B =  $1 + r/100$

Where, 'r' refers to the per centage rate of compound growth of area / production / yield in states per annum.

By taking logarithm of both sides of the equation,

$$\ln Y_t = \ln A + t (\ln B)$$

Per centage rate of compound growth per annum was calculated as:

$$r = [\text{antilog}(\ln b) - 1] \times 100$$

Student's t-test was used to test the significance of r.

#### RESULTS AND DISCUSSION

The results have been discussed under following sub heads:

- State-wise Share of Area, Production and Yield of Total Pulses in India.
- Trends of area, production and yield of total pulses in India.
- Impact of NFSM- Pulses on area, production and yield of pulses in India

#### State-wise Share of Area, Production and Yield of Total Pulses in India

##### State-wise share of Total Pulses Area

The state-wise share of total pulses acreage has been presented in Table 1. The table showed that during 1970-71, total pulses area was mostly spread in Madhya Pradesh (18.84 per cent), Uttar Pradesh (16.53 per cent), Rajasthan (16.04 per cent), Maharashtra (11.05 per cent), Bihar (7.3 per cent), and Andhra Pradesh (6.44 per cent). Madhya Pradesh, Uttar Pradesh and Rajasthan alone contributed about 50 per cent of total pulses area during this period. Over the time, area under major pulses growing states viz. Uttar Pradesh, Bihar and Rajasthan showed overall decrease in pulses area while the area under pulses in Madhya Pradesh increased significantly from 4245.8 thousand hectares to 6372.7 thousand hectares. Area under pulses in Andhra Pradesh and Maharashtra increased marginally over time. Haryana (5.06 per cent), West Bengal (2.95 per cent) and Punjab (1.84 per cent) which occupied noticeable area under pulses in the beginning of the period, recorded abrupt downfall in the area over the years which might be due to introduction of green revolution technology and increase in profitability of competing crops, the cereal crops might have replaced area under pulses. It was also worth noting that southern states like Karnataka and Tamil Nadu doubled the area under pulses in span of five decades. With the decreasing trends in pulses area in northern and eastern zones and increasing area under pulses in southern zones of India, overall India showed marginal increase of 1.01 million hectares over the time of 45 years with the highest area coverage of 26.28 million hectares during year 2010-11.

##### State-wise share of Total Pulses Production

The share of major states in total pulses production has been depicted in Table 2. The perusal of Table 2 revealed that more than 50 per cent of total pulses in India were produced in Uttar Pradesh (25.97 per cent), Madhya Pradesh (16.85 per cent) and Rajasthan (15.04 per cent) during 1970-71. After more than five decades, Madhya Pradesh's contribution to total pulses production increased to the highest of 32.97 per cent while total

Table 1: State-wise total pulses acreage in India, 1970-71 to 2014-15

States	Area (000' ha)									
	1970-71	1975-76	1980-81	1985-86	1990-91	1995-96	2000-01	2005-06	2010-11	2014-15
Andhra Pradesh	1450.9 (6.44)	1447.8 (5.92)	1445.7 (6.44)	1350.2 (5.53)	1631.9 (6.62)	1610.6 (7.23)	1902.2 (9.35)	1781.7 (7.96)	2130 (8.11)	1451.2 (6.16)
Bihar	1644.8 (7.3)	1531.3 (6.26)	1367.8 (6.09)	1233.1 (5.05)	1175.7 (4.77)	921.8 (4.14)	833.5 (4.1)	888 (3.97)	1012 (3.85)	1095.8 (4.65)
Gujarat	423.2 (1.88)	447.7 (1.83)	553.6 (2.46)	756.2 (3.1)	931.6 (3.78)	841 (3.77)	635.1 (3.12)	777 (3.47)	852 (3.24)	654 (2.78)
Haryana	1140.7 (5.06)	1193.8 (4.88)	803.8 (3.58)	832.7 (3.41)	736.5 (2.99)	423.5 (1.9)	159.9 (0.79)	189.8 (0.85)	199 (0.76)	179.5 (0.76)
Karnataka	1131.3 (5.02)	1438.5 (5.88)	1485.7 (6.61)	1583.6 (6.48)	1621.5 (6.58)	1519.4 (6.82)	2046.7 (10.06)	1981 (8.85)	2699 (10.27)	2286 (9.71)
Madhya Pradesh	4245.8 (18.84)	4793.7 (19.61)	4576.3 (20.38)	5142.2 (21.06)	5012.6 (20.33)	5176.9 (23.24)	4222.7 (20.75)	5234.6 (23.38)	6034 (22.96)	6372.7 (27.06)
Maharashtra	2490.7 (11.05)	2911.7 (11.91)	2804.4 (12.49)	2859.7 (11.71)	3257.3 (13.21)	3305 (14.83)	3557.3 (17.48)	3432 (15.33)	4070 (15.49)	2977 (12.64)
Odisha	844.8 (3.75)	1133.3 (4.64)	1725.5 (7.68)	1814.9 (7.43)	1957.9 (7.94)	929.7 (4.17)	604.3 (2.97)	809.2 (3.61)	852 (3.24)	811 (3.44)
Punjab	413.7 (1.84)	438.5 (1.79)	337.5 (1.5)	224.7 (0.92)	146.4 (0.59)	102.7 (0.46)	60 (0.29)	32.6 (0.15)	26 (0.1)	59 (0.25)
Rajasthan	3615.9 (16.04)	4478.4 (18.32)	3147.2 (14.01)	3890.6 (15.93)	3682.8 (14.93)	3573.9 (16.04)	2374.8 (11.67)	3444.6 (15.38)	4710 (17.92)	3574.4 (15.18)
Tamil Nadu	481.6 (2.14)	470.9 (1.93)	532.6 (2.37)	840.1 (3.44)	863.4 (3.5)	577.3 (2.59)	687.9 (3.38)	525.3 (2.35)	728 (2.77)	886.9 (3.77)
Uttar Pradesh	3724.8 (16.53)	3155.3 (12.91)	2862.3 (12.74)	3158.1 (12.93)	3040.2 (12.33)	2829.9 (12.7)	2720.2 (13.37)	2811.7 (12.56)	2504 (9.53)	2585.1 (10.98)
West Bengal	664.9 (2.95)	727.2 (2.97)	523.8 (2.33)	420.6 (1.72)	313.6 (1.27)	210.4 (0.94)	274 (1.35)	222 (0.99)	192 (0.73)	246.7 (1.05)
Rest of India	267 (1.18)	282 (1.15)	294 (1.31)	313 (1.28)	289 (1.17)	258 (1.16)	271 (1.33)	261 (1.16)	272 (1.04)	371 (1.57)
India	22540	24450	22460	24420	24660	22280	20350	22390	26280	23550

Source: Anonymous (2016b)

Figures in the parentheses are percentages to respective values

production in Uttar Pradesh reduced by 26.64 per cent during the same period. Rajasthan remained as major pulses producing state throughout the period with marginal increase of 392.5 thousand tonnes in total production. Haryana, West Bengal and Punjab showed decrease in total production, most probably due to reduction in area. In India, overall increase in production of 5.7 million tonnes could be observed over the time with maximum production of 18.24 million tonnes. The increase in production of total pulses in India was supported by various initiatives, schemes and program sponsored by Government of India to increase yield and thus increase in production.

#### State-wise share of Total Pulses Yield

State-wise yield of total pulses in India has been presented in Table 3. It is observed that yield of total pulses over the course of time has increased significantly in major pulses producing states of India. Punjab and Haryana recorded the highest yield of 747 and 713 kg per ha respectively during 1970-71 which might have been

supported by fertile soil, accessible irrigation facilities but the yield in other states was below India's average with the lowest 242 kg per ha in Tamil Nadu. Low yielding varieties, biotic and abiotic stress, traditional cultivation practices and negligence in pulse research and development could be the reasons for low yield during 1970s and 1980s. India being the highest consumer and importer of pulses in the world, and inadequate production within country, Government of India has taken various initiatives for increasing productivity. As a result, yield has improved significantly over the period in all states of India. In 2014-15, Bihar recorded maximum yield of 1206 kg per ha followed by 945 kg per ha in West Bengal. The table also revealed that although yield in overall India has increased over the period of time, huge variation in yield across states could be observed with the lowest of 412 kg per ha in Tamil Nadu. In spite of increasing trend in yield, India's average yield is still below World's average hence it could be stated that potential maximum yield is still to be achieved in India.

**Table 2: State-wise Total Pulses Production in India, 1970-71 to 2014-15**

States	Production (000' tonnes)									
	1970-71	1975-76	1980-81	1985-86	1990-91	1995-96	2000-01	2005-06	2010-11	2014-15
Andhra Pradesh	449.5 (3.80)	421.1 (3.23)	414.5 (3.90)	629 (4.71)	695.5 (4.88)	771.2 (6.26)	1054.2 (9.51)	1376 (10.28)	1439 (7.89)	1213 (6.91)
Bihar	987.4 (8.35)	822.4 (6.31)	833 (7.84)	887.4 (6.64)	915.8 (6.42)	560.7 (4.55)	716.7 (6.47)	619.1 (4.63)	823 (4.51)	1095.6 (6.24)
Gujarat	165.2 (1.40)	179.6 (1.38)	266.5 (2.51)	338.3 (2.53)	626.6 (4.39)	456.8 (3.71)	190.7 (1.72)	547 (4.09)	720 (3.95)	599 (3.41)
Haryana	813.2 (6.88)	952 (7.30)	504.7 (4.75)	677.9 (5.07)	540.2 (3.79)	412.4 (3.35)	99.4 (0.90)	118.1 (0.88)	184 (1.01)	144 (0.82)
Karnataka	403.6 (3.41)	625.7 (4.80)	462.5 (4.35)	488.9 (3.66)	551.7 (3.87)	688.1 (5.59)	956.2 (8.63)	964 (7.20)	1497 (8.21)	1414 (8.06)
Maharashtra	775.9 (6.56)	1168.3 (8.96)	831.2 (7.82)	1164.1 (8.71)	1443.9 (10.13)	1639.2 (13.32)	1637.4 (14.78)	2005 (14.99)	3146 (17.25)	1805.9 (10.29)
Madhya Pradesh	1991.6 (16.85)	2539.6 (19.48)	2010.8 (18.92)	2610.4 (19.54)	3103.9 (21.77)	3097.7 (25.16)	2542.9 (22.95)	3685.8 (27.55)	3927 (21.53)	5755.5 (32.79)
Odisha	466.6 (3.95)	526.7 (4.04)	886.1 (8.34)	1031.3 (7.72)	1085.8 (7.61)	431.1 (3.50)	212.7 (1.92)	336.3 (2.51)	414 (2.27)	445.3 (2.54)
Punjab	309.1 (2.62)	402.3 (3.09)	199.9 (1.88)	203.7 (1.52)	108.4 (0.76)	84 (0.68)	44.4 (0.40)	26.2 (0.20)	24 (0.13)	54.4 (0.31)
Rajasthan	1777.3 (15.04)	2083.2 (15.98)	1169.7 (11.00)	1766.9 (13.23)	1718.8 (12.05)	1455.8 (11.83)	731.5 (6.60)	898.1 (6.71)	3216 (17.63)	2169.8 (12.36)
Tamil Nadu	116.5 (0.99)	127.4 (0.98)	146.7 (1.38)	322.3 (2.41)	348.2 (2.44)	233.1 (1.89)	312.7 (2.82)	177 (1.32)	296 (1.62)	365.3 (2.08)
Uttar Pradesh	3069.2 (25.97)	2656.7 (20.37)	2523.6 (23.74)	2811.6 (21.04)	2771.9 (19.44)	2189.3 (17.78)	2182.1 (19.69)	2267.5 (16.95)	2079 (11.40)	2251.3 (12.83)
West Bengal	375 (3.17)	410.1 (3.14)	237.8 (2.24)	264.1 (1.98)	193.1 (1.35)	141.1 (1.15)	219.3 (1.98)	174.3 (1.30)	161 (0.88)	233 (1.33)
Rest of India	119.9 (1.01)	124.9 (0.96)	143 (1.35)	164.1 (1.23)	156.2 (1.10)	149.5 (1.21)	179.8 (1.62)	185.6 (1.39)	314 (1.72)	3.9 (0.02)
India	11820	13040	10630	13360	14260	12310	11080	13380	18240	17550

Source: Directorate of Economics & Statistics, Krishi Bhawan, New Delhi. Figures in the parenthesis indicate the per centage to respective values

### Trends of Area, Production and Yield of Total Pulses in India

The state-wise trends of total pulses acreage, production and yield in India from 1970-71 to 2014-15 has been shown in Table 4.

#### Trends of area

The perusal of Table 4 revealed that, during Period-I, the highest increasing trends of 5.13 per cent per annum was recorded in Odisha whereas Punjab experienced the highest negative growth of 5.58 per cent both of which were significant at one per cent level. This period was marked by the introduction of green revolution technology and new improved varieties of cereal as a result, decreasing trends in area in Northern and Eastern zones can be seen throughout this period except Odisha. In Period-II, the area under pulses showed further decreasing trends in Northern and eastern zones while Andhra Pradesh and Karnataka showed highly significant growth of 1.71 per cent per annum and 2.21 per cent per annum. Under Period-III, area under pulses expanded in

northern, central and eastern zones except Odisha which showed statistically non-significant decline. The decreasing trend in Punjab reverted with highest increase in area of 20.61 per cent per annum followed by West Bengal with positive growth of 6.88 per cent per annum in pulses area. During Overall Period, northern and western zones showed significant decrease in area while southern zone emerged as niche area with significant growth in area.

#### Trends of production

The total production of pulses in India during Period-I increased significantly by 0.93 per cent per annum which was statistically significant at one per cent level. The increase in production of overall India in Period-I was contributed by the record rise in production of 6.96 per cent per annum in Gujarat followed by 6.13 per cent per annum in Odisha both of which were statistically significant at one per cent level although there was significant decrease in production in northern zones with highest decrease of 6.23 per cent per annum in Punjab.

Table 3: State-wise Total Pulses Yield in India, 1970-71 to 2014-15

Year	Yield (kg/ha)								
	1970-71	1975-76	1985-86	1990-91	1995-96	2000-01	2005-06	2010-11	2014-15
Andhra Pradesh	310	291	466	426	479	554	772	676	831
Bihar	591	546	852	737	867	1018	1292	974	1206
Gujarat	390	401	447	673	543	300	704	845	916
Haryana	713	797	814	733	974	622	621	925	802
Karnataka	357	435	309	340	453	467	487	555	619
Madhya Pradesh	501	546	380	464	465	751	784	600	772
Maharashtra	312	401	407	443	496	460	584	773	607
Odisha	552	465	568	555	464	352	416	486	549
Punjab	747	917	907	740	818	740	804	923	922
Rajasthan	492	465	454	467	407	308	261	683	607
Tamil Nadu	242	271	384	403	404	455	337	407	412
Uttar Pradesh	492	583	846	863	993	1477	1291	596	679
West Bengal	564	564	628	616	671	800	785	839	945
India	524	533	547	578	553	544	598	694	745

Source: Anonymous (2016c)

During Period-II, growth rate of production decreased in northern and eastern zones with the highest decline of 9.48 per cent per annum in Haryana. Positive growth rate in Andhra Pradesh (4.98 per cent) and Karnataka (3.10) was recorded both of which were statistically significant at one per cent level of significant. During Period-III, the production boosted with significant improvement in production in northern and eastern zones. The production intensified in Punjab by 20.09 per cent per annum while Madhya Pradesh (5.45 per cent) and West Bengal (10.96 per cent) and Bihar (8.91 per cent) also showed highly significant increase in production. During Overall Period, significant drop in production was observed in northern and eastern zones of India which maximum of 6.20 per cent per annum in Punjab while significant increase in production was noticed in southern and western zones with the highest increase of 3.70 per cent per annum in Andhra Pradesh.

#### Trends of yield

The yield showed the positive growth in all across the states during Period-I with the maximum of 3.29 per cent per annum in Andhra Pradesh except for Karnataka and Punjab which registered non-significant decrease in yield. With the significant growth in yield in Andhra Pradesh (3.29 per cent), Tamil Nadu (2.4 per cent), Odisha (0.96 per cent), West Bengal (0.86 per cent), Gujarat (2.40 per cent) and Maharashtra (2.26 per cent) in Period-I, India witnessed positive growth in yield of 0.75 per cent per annum which was found statistically significant at one per cent level. During Period-II, statistically non-significant decline in yield in Haryana, Uttar Pradesh, Tami Nadu, Bihar and Rajasthan was observed, while Maharashtra showed maximum increase in yield of 2.05 per cent per annum. During Period-III, yield in India showed positive and significant growth of 3.53 per cent per annum which was supported by increase in yield all

across the major states, moreover, eastern zone experienced significant improvement in yield with the highest of 5.77 per cent per annum in Bihar which was statistically significant at one per cent level. Over 5 decades, highly significant increase in yield across the major states of India was observed but Odisha showed negative growth of 0.31 per cent per annum which was statistically significant at five per cent level. In India, over the time period yield has increased by 0.98 per cent per annum.

#### Impact of NFSM- Pulses on Area, Production and Yield in India

National Food Security Mission on pulses was launched since Eleventh Plan of the government with the main objective to increase the additional production of 2 million tonnes of pulses at the end of XI<sup>th</sup> plan and further additional of 3 million tonnes target since 12<sup>th</sup> Five Year Plan. To achieve the set goal, the government has emphasized on production and distribution of quality seeds and demonstration of improved practices along with training of extension workers. The farmers were also provided subsidies on micronutrients, plant protection equipments and chemicals and sprinkler sets. After the following intervention by the government, impact of NFSM- Pulses on area, production and yield has been depicted in Table 4.

#### Impact of NFSM-pulses on area

After the initiation of NFSM-Pulses, major impact in area was observed in northern, eastern and southern zones of India. Haryana, Punjab, and Uttar Pradesh showed positive growth in area under pulses after the intervention where significant negative growth rate was prevalent during the preceding periods. Tamil Nadu also showed positive growth in area of 7.38 per cent per annum as compare to negative growth before intervention. In eastern India, Bihar (2.99 per cent) and West Bengal (6.88

Table 4: State-wise Trends (CGR per cent) of Total Pulses Acreage, Production and Yield in India, 1970-71 to 2014-15

States	Area			Production			Yield				
	Period I	Period	Overall	Period	Period	Overall	Period	Period	Overall		
<b>Northern Zone</b>											
Haryana	-4.47**	-8.27**	0.12	-5.16**	-4.04**	-3.99**	6.00	0.45	-1.33	5.86	1.24**
Punjab	<b>-5.58**</b>	-8.65**	20.61**	-6.53**	-6.23**	-6.20**	20.09**	-0.70	0.25	-0.44	0.35**
Uttar Pradesh	-0.92**	-0.75**	0.53	-0.7**	-0.11	-0.41**	0.81	0.82	-0.40	0.28	0.29**
<b>Southern Zone</b>											
Andhra Pradesh	0.39**	1.71**	-3.42	0.91**	3.70**	3.70**	-0.88	3.29**	0.87	2.63	2.76**
Karnataka	2.11**	2.21**	0.41	1.58**	1.76*	2.47**	6.14*	-0.33	0.87	5.71**	0.88**
Tamil Nadu	<b>3.02**</b>	-2.04**	7.38	0.28	5.50**	1.34**	16.39*	2.4**	-0.69	8.38	1.06**
<b>Eastern Zone</b>											
Bihar	-1.78**	-0.8*	2.99**	-1.23**	0.24	0.15	8.91**	2.05	-0.15	5.77**	1.40**
Odisha	5.13**	-4.11**	-0.77	-1.59**	6.13**	-1.89**	1.95	0.96*	-1.25*	2.74**	-0.31*
West Bengal	-4.06**	-1.38**	6.88**	-2.92**	-3.24**	-1.71**	10.96**	0.86**	1.25**	3.18**	1.25**
<b>Western Zone</b>											
Gujarat	<b>4.46**</b>	-0.84	-2.09	1.55**	6.96**	3.50**	1.47	2.40**	0.65	3.64**	1.92**
Maharashtra	1.63**	0.83**	-0.02	0.94**	3.93**	2.90**	1.91	2.26**	2.05**	1.95	1.94**
Rajasthan	-1.55**	-0.38	-0.32	0.02	-1.46	0.49	9.42	0.09	-0.74	9.77	0.47
<b>Central Zone</b>											
Madhya Pradesh	<b>0.48**</b>	0.36	2.47**	0.59**	1.12**	2.09**	5.45**	0.63	0.46	2.90	1.50**
India	<b>0.18</b>	-0.10	0.82	0.06	0.93**	1.05**	4.39**	0.75**	0.38	3.53**	0.98**

\*\* and \* indicate significance at 1 and 5 per cent level respectively

per cent) showed positive growth both of which were statistically significant at one per cent level as compare with the negative growth before NFSM-Pulses was initiated. Madhya maintained highly significant growth rate of 2.47 as compare with the non-significant before NFSM-Pulses intervention.

#### **Impact of NFSM-pulses on production**

The mission was successful in achieving additional 2 million tonnes in production at the end of the plan. The success of mission was supported by the positive increase in production all across the major states which might be because of distribution of quality seeds, demonstration of improved cultivation practices and subsidies provided in macronutrients and plant protection equipments. The highest significant growth of 20.09 per cent was recorded in Punjab followed by Tamil Nadu (16.39 per cent), West Bengal (10.96 per cent) and Bihar (10.94 per cent) as compare with the significant decline in production which was prevalent before the start of program. Karnataka and Madhya Pradesh production also increased significantly against the previous periods.

#### **Impact of NFSM-pulses on yield**

After NFDM-Pulses, abrupt increase in yield from -0.15 per cent per annum and -0.25 per cent per annum to 5.77 per cent per annum and 2.74 per cent per annum were observed in Bihar and Odisha respectively. Karnataka, (5.71 per cent), West Bengal (3.18 per cent) Gujarat (3.64 per cent) also showed significant increase in as compare with the preceding periods. The overall impact of NFSM-Pulses on yield was observed in eastern zone where highly significant increase in yield was observed with the start of NFSM-Pulses.

#### **CONCLUSIONS And POLICY OPTIONS**

India being the largest consumer and importer of pulses in the world, the production base of pulses needs to be strengthen in the country. Past scenario and present

status of pulses showed that area and production has shifted from northern and eastern zones to southern zone of India over the study period. Maharashtra, Uttar Pradesh, Rajasthan and Madhya Pradesh were the major pulses producing states with the contribution of about 65 per cent of total pulses area and about 68 per cent of total production in 2014-15 but the average yield of former three states were below India's average reflecting need of region specific research and plans to bridge yield gap and trigger the production. NFSM-Pulses which showed positive result in strengthening pulses production base overall India need to be further reinforced through region specific plans and targets. The supportive role by government in promoting niche states in pulses production like Karnataka, Tamil Nadu and Gujarat could further lead to self-sufficiency in pulses production in India.

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## Economic Analysis of Value Added Product Phule Drinks (Mango)

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### ABSTRACT

Mango occupies a prominent place among the fruits grown in India because of its great utility. The processed products viz; Phule (Mango) drinks, are rich in vitamins, minerals and nutrients. The Phule (Mango) drink was selected for study as it is produced and marketed on large scale at jurisdiction of University. The quantity of Mango used for processing was 983 kg. The total cost on account of raw material (Mango) was ₹39320. The quantity of Phule drinks produced from 983 kg mango was 2496 lit with the recovery of 253.92 per cent. The processing cost was ₹54.20 per litre. The Phule drinks have a net profit of ₹14244.39. The added gross returns were ₹110440 while net returns were ₹14244.39. The benefit cost ratio in RTS Phule(Mango) drinks processing was 1.11 at counter sale, indicated that each rupee invested fetched higher returns from this processed products. It is recommended to commercialize the processing of value added product viz; Phule (Mango) drink and make it popular in domestic and urban market at University level or through Public Private Partnership (PPP) mode.

### Keywords

Mango, phule drinks, processing, production and marketing, value addition

### JEL Codes

L20, L22, M30, M311, M39

### INTRODUCTION

Mango is one of the most important exported fruits and is acknowledged as the king of tropical fruits. The major portion of the harvest is consumed locally as fresh ripe mango due to its excellent colour and aroma. Generally, the aroma components are located in the mango pulp. (Gourge *et al.*, 1992; Subramanyam *et al.*, 1975). Various types of processed products are prepared from mango are pickles, chutneys, squash, jam, juices, mango leather and mango pulp.

The processed products viz; Phule(Mango) drinks, are rich in vitamins, minerals and nutrients. Mango Juice is a good source of Vitamin C, Vitamin A, (Reddy & Kumar, 2010). Mango Juice is very useful to prevent cancer, lowers cholesterol levels, maintain blood pressure, beneficial for Anemia, helps in diabetes, etc.

The processing of Mango juice is therefore important. The Phule (Mango) drink was selected for study as it is produced and marketed on large scale at jurisdiction of University.

### OBJECTIVES

a) To estimate the production cost of Phule

(Mango) drinks

- To examine the profitability of Phule (Mango) drinks.
- To study the marketing cost of Phule (Mango) drinks
- To study the problems in processing and marketing of Phule (Mango) drinks.

### METHODOLOGY

Post-Harvest Technology Unit (PHT) was established in the year 1998 at Central Campus, MPKV, Rahuri. PHT unit is preparing different value added products viz; Mango pulp, mango drink, Jamun juice, jamun powder, Aonla candy, aonla drink, aonla supari etc. Among the value added products, Phule (mango) drinks were selected on the basis of volume and sale of these value added products. The installed capacity of Phule drinks is 250 l/day.

The data on fixed inputs, variable inputs, total quantity processed, total sale etc were collected from PHT unit for the year 2014-15. Data were analyzed by using simple arithmetical and statistical tools such as percentages, averages, ratios etc. The Break- even analysis was also

estimated by following formulas.

$$Q = \frac{TFC}{[Pc - AVC]}$$

Where,

Q= Quantity of processed product required for break even

TFC= Total fixed cost (₹)

Pc= Sale price of processed Product (per litre)

AVC= Average variable cost (per litre)

## RESULTS AND DISCUSSION

### Quantity Processed by PHT unit.

Quantity of value added product used for processing is given in Table 1. It is revealed from the Table 1 that, the quantity of Mango used for processing was 983kg. The purchase rate for mango was ₹40/kg. The total cost on account of raw material (mango) was ₹39320. The quantity of value added product (Phule drinks) was 2496 lit with the recovery of 253.92 per cent.

**Table 1: Quantity of mango used for processing**

Items	Quantity
Raw material processed (kg)	983
Purchase rate (₹/kg)	40
Raw material price (₹)	39320
Total quantity produced (200 ml bottle)	12480
Total quantity produced (litres))	2496
Sale rate per bottle (Per 200 ml bottle)	12
Recovery (per cent)	253.92

### Fixed Cost

Investment on fixed inputs is given in Table 2. It is revealed from the Table 2 that, the investment on building was the major item of fixed capital (13.42 per cent), followed by depreciation (9.20 per cent) and land rent (7.03 per cent) respectively for the value added products, viz; mango phule drinks.

**Table 2: Fixed capital investment for processing of Phule drinks**

Items	Investment (₹)	Per cent to total
Land rent	650	7.03
Building	1240	13.42
Depreciation (Furniture and Equipment)	850	9.20
Interest on fixed capital	6500	70.35
<b>Total</b>	<b>9240</b>	<b>100.00</b>

In similar manner, Karthick *et al.* (2013) studied the total investment cost of mango pulp processing industry and revealed that the cost invested in building and land value accounted for 12.11 and 2.11 per cent of the total investment.

### Variable cost

In total variable cost, the cost on account of packing

material (39.53 per cent) was the major item of cost and was followed by raw material (31.14 per cent) cost for Phule drinks. The total variable cost for processing the Phule drinks was ₹126275.61.

**Table 3: Variable inputs used for processing of Phule drinks**

Items	Amount (₹)	Percentage to the total
Mango fruits price	39320	31.14
Fuel cost	1000	0.79
Labour	10000	7.92
Packing cost	59904	47.44
<b>Additives, preservatives, colour etc.</b>		
i) Citric acid	539	0.43
ii) Preservatives	39.93	0.03
iii) Sugar	8125	6.43
Others expenses (Light bill, stationery)	200	0.16
Working capital	119127.93	94.34
Interest on working capital @ 6 per cent	7147.68	5.66
<b>Total variable cost Rs.</b>	<b>126275.61</b>	<b>100.00</b>

Karthick *et al.* (2013) revealed that the processing industry is raw material intensive with 80.37 percent of the total variable cost were incurred for procurement of mango fruit, the share of packing material accounted 10.31per cent,the cost incurred for wages accounted to 1.48 per cent total variable cost.

### Processing cost of Phule drinks

The detailed processing cost is presented in Table 4. It is revealed from the Table 4 that, variable cost has the major share in total cost for the Phule drinks. It accounts to 93 per cent. The processing cost of Phule drinks was ₹54.20 per litre.

**Table 4: Processing cost of Phule drinks**

Items	Value (₹)	Percentage to the total
Fixed cost	9240	<b>6.82</b>
Variable cost	126275.61	93.18
<b>Total cost (FC+ VC)</b>	<b>135515.61</b>	<b>100.00</b>
Per 200 ml bottle	10.86	
Per litter cost	54.20	

### Cost and returns

Cost and returns, value addition and profitability for Phule drinks are presented in Table 5 and 6. The resulted revealed that Phule drinks processing was profitable. The Phule drinks have a net profit of ₹14244.39. The benefit-cost ratio for Phule (Mango) drinks was 1.11.

### Value addition and profitability

The added gross returns were ₹1,10,440 and net returns of ₹14,244.39. The ICBR ratio was 1.15 which

**Table 5: Costs and returns for processing of Phule drinks**

Items	Value (₹)
Total returns	149760
Total cost	135515.61
Net returns	14244.39
<b>B: C Ratio</b>	<b>1.11</b>

**Table 6: Value addition and profitability**

Items	Amount (₹)
Cost of raw material	39320
Cost of fruit processing	96195.61
<b>Total cost</b>	<b>135515.61</b>
<b>Gross return</b>	<b>149760</b>
Net returns	14244.39
Gross return/kg	44.25
Net returns/kg	5.71
Added cost	96195.61
Added returns	110440
Added cost/kg	38.54
Added returns/kg	44.25
<b>ICBR Ratio</b>	<b>1.15</b>

indicates that processing of mango drinks was a profitable enterprise.

**Price spread**

There are two marketing channels observed for marketing of Phule drinks (Channel-I: Producer-Retailer-Consumer and Channel-II: Producer-Consumer). The price spread of Phule drinks is given in Table 7.

It is revealed from the Table 7 that Only 6 per cent of total Phule drinks produced were sold through Channel-I and remaining 94 per cent was sold on counter itself. It is interesting note that, Phule drinks sold through retailer at nearer to PHT unit received 15 per cent margin. So, that the producer (PHT unit) shares in consumer rupee was 80 per cent in Channel-I.

It is concluded from the above discussion that, if University sold the mangodrinks through counter sale at different locations viz; Shani Shingnapur, Shirdi, University get, etc. definitely, the PHT unit will earn more profit than University counter sale.

**Break- even Analysis**

The term break-even point is used to describe the percentage of capacity operation of manufacturing plant at which income will just cover the expenses. The estimated break- even quantities of Phule drinks, required to be processed is presented in Table 8.

It is evident from the Table 8 that, the actual quantities of Phule drinks processed was much higher than that the

**Table 7: Price spread of phule drinks marketing**

Particulars	Marketing channel (₹)	
	I	II
Producers price	8 (80)	8 (100)
Marketing cost incurred by Retailer	0.5 (5)	--
Retailers margin	1.5 (15)	--
Selling price of retailer	10	--
Consumers price	10 (100)	8 (100)
Producers share in consumers rupee (Per cent)	80	100
Quantity sold (2014-15) 200 ml bottle	720 (5.77)	11760 (94.23)

**Table 8: Break-even point Analysis for processing of Phule drinks**

Items	Value
Fixed cost (₹)	9240
Sale price per kg of processed products	60
Variable cost per kg of processed products	50.59
Actual quantities processed (l/kg)	2496
Quantities required to be produced for the break-even (l/kg)	982.06

quantity of the value added products required for break-even. It is therefore inferred that, the performance of Phule drinks processing was satisfactory and it is a profitable unit.

**Problems of Processing and Marketing**

The major problems regarding processing werestorage, shortage of skilled manpower, shortage of raw material due to seasonal availability of fruits, wastage of raw material, under-utilization of installed capacity, weak marketing chain, etc.

**CONCLUSIONS**

1. The average quantity of Phule drinks prepared by PHT unit was 2496 litres. The 983 kg mango (raw material) was utilized for producing 2496 litres RTS Phule drinks, with recovery of 253.92 per cent, respectively.
2. The cost of processing for RTS Phule(Mango) drinks was ₹52.20/litre,
3. The benefit cost ratio obtained in RTS, Phule drinks was 1.11. It indicates that the performance of RTS, Phule drinks was satisfactory and it is a profitable venture.
4. Net returns for Phule drinks were (₹14244.39).

5. The ICBR ratio of Phule drink was 1.15 indicates that it is profitable venture.
6. At present, more than 90 per cent, processed products were sold at counter only. Hence, it is necessary to sell the processed products at different locations for commercialization purpose.
7. Consumer awareness to be increased through advertizing, attractive packing, selling at cosmopolitan cities, or at pilgrim centers.

#### **POLICY IMPLICATION**

The benefit cost ratio in ready to serve (RTS) Phule (Mango) drinks processing was 1.11 at counter sale, indicated that each rupee invested fetched higher returns from this processed products. It is recommended to commercialize the processing of these value added products and make it popular in domestic and urban

markets at University level or through Public Private Partnership (PPP) mode.

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## **Adverse Effect of Land Degradation on Farm Productivity and Income in North-West India**

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### **ABSTRACT**

India has about 147 Mha degraded land. Soil salinity is one of the major land degradation problems in Indian agriculture which adversely affects the crop productivity in about 2.95 Mha area. Several studies reported the adverse effect of land degradation in India as well as in the world. This study has made an attempt to estimate production and monetary losses due to soil salinity in Haryana. Haryana state has 95765 ha saline area, out of which 77061 ha (80.47 per cent) is under cereals production. Rice (*kharif* season) and wheat (*rabi* season) crops occupy prominent place among the cereals production in Haryana. Hence these crops were assumed as representative crops and the damage due to salinity was assessed. The annual potential and actual losses per ha due to soil salinity was ₹10807 and ₹9314, respectively. The total monetary loss arises due to soil salinity in the project area is ₹3.67 million. In view of doubling farmers' income by 2022, the policy makers have to give more emphasis on land degradation aspects particularly saline soil reclamation which is a major concern of worry by the salinity affected farmers of Haryana as well as India.

### **Keywords**

Degradation, damage assessment, Haryana, salinity

### **JEL Codes**

O13, Q15, Q18

### **INTRODUCTION**

One of the major agenda of the Government of India on farming policies in recent years towards doubling farmers' income by 2022 is "Improving farm incomes by increasing productivity". But soil degradation is one among the several factors that hinders Indian agriculture. Soil degradation has become a serious problem in both rainfed and irrigated areas in India. It is estimated to be occurring on 147 Mha of land (Anonymous, 2005). Soil salinity is one of the major land degradation problems in Indian agriculture which adversely affects the productivity of agricultural land. The saline soils are characterized by the presence of excess neutral soluble salts like chlorides and sulphates of sodium, calcium and magnesium. Sodium chloride is the dominant salt. High soil salinity is often accompanied by high water table, often within 2 m of soil surface. Sub-soil waters are generally salty and, therefore, their use for irrigation presents major constraints to crop production. In general, these soils have good physical properties but poor natural drainage. The formation of saline soils is generally associated with the rise in water table due to introduction

of irrigation and inadequate drainage. To mitigate the adverse effect of soil salinity on crop yield, the farmers irrigate frequently using canal water and ground water. Due to differences in environmental parameters in the farming systems, such as groundwater quality, soil types and uneven distribution of irrigation water, income losses to the farming community are not uniform (Datta & Jong, 2002). This study highlights the economic losses due to land degradation by the problem of soil salinity, which threatens the sustainability of agricultural production in Haryana state.

India has 2.95 Mha area affected by soil salinity (Sharma *et al.*, 2015). Out of 1Mha of irrigation induced waterlogged saline area in north-west India, approximately 0.5 Mha are in the state of Haryana (Datta and Jong, 2002). In the Indo-Gangetic basin in India, the crop yield losses on salt-affected lands were 40 per cent in wheat, 45 per cent in rice, 48 per cent in sugarcane and 63 per cent in cotton (Tripathi, 2009). India is losing a huge amount of money from degraded lands. This cost is documented by declining crop productivity, land use intensity, changing cropping patterns, high input use and

declining profit (Datta *et al.*, 2002, 2004; Thimmappa *et al.*, 2014). Recent estimates in Haryana (Sharma *et al.*, 2015) showed that saline soils are spread in the area of 95765 ha and total losses resulting from salinization was 118469 tonnes in terms of production and ₹1238071609 in terms of monetary loss. The maximum area of 77061 ha (80.47 per cent) in the state is under cereals production (Sharma *et al.*, 2015) and the respective production and monetary losses occurred from cereals production were 68272 tonnes (57.65 per cent) and ₹881675758 (71.21 per cent). The district wise details of area under salinity, production and monetary losses are presented in Table 3. In Haryana, the cereals production, i.e., rice and wheat are the major crops of *kharif* and *rabi* seasons. Fatehabad district, in which the subsurface drainage project is located, is the base for our study. The district has 1787 ha area under soil salinity and has highest area under cereals production. Hence, the production and monetary losses for rice and wheat crops were assumed to be proper representation of our diagnosis, and the damage assessment has been estimated from rice and wheat crops.

## MATERIALS AND METHODS

### General features of the study area

The study area, village Banmandori is located in the Bhattu block of Fatehabad district in Haryana state. Total area under subsurface drainage is 277 ha, which covers 152 farmers. Waterlogging and salinity problems both occur in the study area. Waterlogging is more predominant in *kharif* and soil salinity in *rabi* seasons. The socio-economic profile of the sample farmers reveals that average family size is seven persons and literacy rate is 60 per cent (Table 1). Majority farmers belong to medium age (43 years) category. The annual rainfall of the district for last 10 years ranges between 75 to 426 mm and the mean temperature varies between 5.5 to 41.6°C. Farmers deriving their family income mainly from crop production (52 per cent) and livestock (22 per cent). Approximately 72 per cent of the study area farmers

**Table 1: Socio-economic profile of the sample farmers**

Particulars	Percentage/Value
<b>General information</b>	
Family size (No.)	7
Literacy level ( per cent)	60
Age (years)	43
Average farm size (ha)	1.47
<b>Sources of family income (Per cent)</b>	
Crop production	52
Livestock	22
Other Sources	19
<b>Classification of farm holdings (Per cent)</b>	
Marginal (<1 ha)	49
Small (1-2 ha)	23
Medium (4-10 ha)	8

belong to the small and marginal category. The average farm size of the sample farmers were 1.47 ha.

### Analytical Approach

To assess the damage caused by varying degrees of water logging and soil salinity and their effect on land productivity and farm income, both primary and secondary data were considered and analysed. General indicator for water logging is depth of the water table and for soil salinity; it is the electrical conductivity (ECe) of the saturated (soil) paste. Ground water quality also expressed in terms of electrical conductivity (EC). Crop productivity is measured by recording crop yields. Land productivity was assessed by determining cropping intensity and cropping pattern (Datta *et al.*, 2004).

To assess the soil salinity, soil samples were collected from sample plots and soil analysis was made. Later, the data sets have been classified according to degree of soil salinity at the harvest of the crops. Soil salinity of one acre sample plots have been grouped into four classes (Mandal *et al.*, 2010) i.e., normal soil (0-4 dS/m), slightly saline (4.1-8.0 dS/m), moderately saline (8.1-16 dS/m) and severely saline (>16 dS/m). Many common agricultural crops, including rice and wheat, are not affected in the range of 0-4 dS/m. We used this class as the non-affected standard. No crops were grown on land with an ECe above 16 dS/m (Datta and Jong, 2002, and Raju *et al.*, 2016).

Land holding distribution of the study area as per soil salinity classes (Table 2) reveals that out of 1370 ha land area of the village, 1030 ha (75.18 per cent) land was normal. The remaining 340 ha (24.82 per cent) area was affected by soil salinity, out of which 187.18 ha (13.66 per cent) land has slight salinity, about 57.08 ha (4.17 per cent) land has moderate salinity and 95.74 ha (6.99 per cent) area is severely saline. In severe saline land no crop has been grown for many years.

**Table 2: Distribution of landholding under different soil salinity classes in village Banmandori**

Soil salinity classes	ECe range (dS/m)	Area (ha)	Area (per cent)
Normal	0-4	1030.00	75.18
Slightly saline	4.1-8.0	187.18	13.66
Moderately saline	8.1-16.0	57.08	4.17
Severely saline	>16	95.74	6.99
Total		1370.00	100.00

Source: Mandal *et al.* (2010)

## RESULTS AND DISCUSSION

### Area under soil salinity, monetary and production losses in Haryana

About 95765 ha area is under soil salinity in Haryana (Table 3). The districts having maximum area under salinity were Gurgaon (17.66 per cent), Rohtak (17.52 per cent), Hissar (16.12 per cent) and Jhajjar (10.49 per cent). The district with least salinity were Bhiwani (0.22 per cent), Rewari (0.58 per cent), Sirsa (0.60 per cent) and

Kaithal (0.89 per cent). In terms of production losses, Gurgaon, Rohtak and Hisar showed maximum loss of 15.76, 15.29 and 14.84 per cent, respectively. The districts with least production losses were Bhiwani, Sirsa and Rewari with loss of 0.05, 0.07 and 0.19 per cent, respectively to the states total. The monetary loss was maximum in Hisar and Gurgaon districts with 27.18 per cent and 19.22 per cent respectively. The estimates showed about 0.11 million tonnes of foodgrain production loss brings a monetary loss of ₹ 123.81 million in Haryana.

### Cropping Pattern

The cropping pattern of study area during both *kharif* and *rabi* seasons is depicted in Table 4. The major *kharif* crops were cotton (51.51 per cent) followed by rice (11.45 per cent) and guar (16.01 per cent) and in *rabi* season, wheat (71.10 per cent) was the most important crop followed by mustard (13.83 per cent). The fallow land remains almost same for both *kharif* (10.88 per cent) and *rabi* (11.46 per cent) seasons. The fallow land in the study area is rather high due to waterlogging and salinity problem.

### Cropping Intensity

The cropping intensities according to soil salinity classes are shown in Table 5. The average cropping intensity of village Banmandori for the period 2010-2014 are 86 per cent each in *kharif* and *rabi* seasons and thus it is 172 for the whole agricultural year.

### Crop yields

Average crop yields have been determined for each soil salinity classes (Tables 6 and 7). Rice and wheat has been assumed to represent the *kharif* crop and *rabi* crops,

**Table 4: Cropping pattern in *kharif* and *rabi* seasons in the study area**

<i>Kharif</i> crops	Percentage	<i>Rabi</i> crops	Percentage
Cotton	51.51	Wheat	71.10
Rice	11.45	Mustard	13.83
Guar	16.01	Barley	1.31
Bajra	3.96	Oats	0.88
Groundnut	4.04	Berseem	0.24
Fodder	1.05	Castor	0.15
Other crops	1.10	Other crops	1.02
Fallow land	10.88	Fallow land	11.46
Total	100.00	Total	100.00

respectively. Starting from lowest salinity class (slightly saline) to the higher salinity class (severely saline) the yield of rice and wheat crops decreases significantly. The yield reduction in rice was 27 per cent for slightly saline and 51 per cent for moderate saline soils compared to normal soils. Similarly, the yield reduction in wheat was 20 per cent and 43 per cent, respectively for slight and moderately saline soils as compared to normal soils in the region. Severe saline soils have 100 per cent yield reduction for both rice and wheat, as no crops were grown on such soils.

In all categories of salinity affected land the yield reductions of rice and wheat crops were similar. There are small variations from year to year in the less affected areas. However, the yield variation in the moderately affected land was larger for both rice and wheat. This may be due to the extreme conditions of salinity and to the fact that the farmers are inclined to give most attention to crops grown

**Table 3: District-wise area under salinity, production and monetary losses in Haryana**

Districts	Area (ha)	Per cent to total	Production loss (t)	Per cent to Total	Monetary loss (₹)	Per cent to Total
Ambala	1350	1.41	2148	1.81	14059276	1.14
Bhiwani	209	0.22	62	0.05	480375	0.04
Faridabad	3735	3.90	6673	5.63	42445020	3.43
Fatehabad	1787	1.87	1998	1.69	24203569	1.95
Gurgaon	16910	17.66	18669	15.76	238004621	19.22
Hisar	15440	16.12	17577	14.84	336530998	27.18
Jhajjar	10045	10.49	10149	8.57	69540779	5.62
Jind	7132	7.45	5910	4.99	68772579	5.55
Kaithal	855	0.89	1304	1.10	14765725	1.19
Karnal	6776	7.08	11644	9.83	90009013	7.27
Kurukshetra	7259	7.58	6871	5.80	83535402	6.75
Panipat	1684	1.76	6019	5.08	49948243	4.03
Rewari	556	0.58	224	0.19	2819665	0.23
Rohtak	16774	17.52	18114	15.29	109265751	8.83
Sirsa	579	0.60	84	0.07	1048507	0.08
Sonepat	4674	4.88	11023	9.30	92642086	7.48
Yamunanagar	0	0.00	0	0.00	0	0.00
Total	95765	100	118469	100	1238071609	100

Source: Sharma et al. (2015)

**Table 5: Cropping intensity by soil salinity class**

Soil salinity classes	2010-11	2011-12	2012-13	2013-14	Average
Normal	198	197	197	196	197
Slight	187	189	189	182	187
Moderate	175	176	181	177	177
Severe	126	129	129	127	128
Annual Average	172	173	174	171	172
Average in <i>kharif</i>	87	87	87	83	86
Average in <i>rabi</i>	85	86	87	88	86

**Table 6: Average yield (t/ha) of rice in different soil salinity**

Year	Soil salinity classes			
	Normal	Slight	Moderate	Severe
2010-11	4.21	3.13	2.08	0
2011-12	4.33	3.18	2.13	0
2012-13	4.27	3.11	2.05	0
2013-14	4.45	3.21	2.17	0
Average	4.32	3.16	2.11	0
Yield loss (per cent)		27	51	100

**Table 7: Average yield (t/ha) of wheat in different soil salinity**

Year	Soil salinity classes			
	Normal	Slight	Moderate	Severe
2010-11	4.65	3.74	2.73	0
2011-12	4.78	3.75	2.55	0
2012-13	4.86	3.89	2.77	0
2013-14	4.89	3.87	2.82	0
Average	4.80	3.81	2.72	0
Yield loss (per cent)		20	43	100

on the relatively better soils and crops (Datta *et al.*, 2002).

#### Cost of cultivation and cost of production

The average cost of cultivation (₹/ha) as well as cost of production (₹/t) was determined for each soil salinity classes separately for rice (Table 8) and wheat (Table 9). The cost of cultivation was almost uniform throughout the salinity classes. It ranges between ₹380003 to ₹40739 for rice and ₹35371 to ₹38670 for wheat. This may be due to approximately same quantity of inputs used and similar number of farm operations were performed across the soil

salinity classes. However, the cost of production showed a significant difference across the soil salinity classes. This was mainly due to reduction in yield affected by higher salinity in the region. The cost of production in rice was higher by 40 per cent and 91 per cent in slight and moderate salinity, respectively, as compared to the normal soil class. Similarly, the cost of production of wheat was higher by 28 per cent and 61 per cent, respectively, for slight and moderate salinity classes as compared to the normal soil class in the region.

**Table 8: Average cost of production of rice crop in various salinity classes**

Year	Normal		Slight		Moderate		Severe	
	₹/ha	₹/ha	₹/ha	₹/ha	₹/ha	₹/ha	₹/ha	₹/ha
2010-11	39665	9422	42015	13423	36321	17462	0	0
2011-12	41113	9495	41652	13098	37562	17635	0	0
2012-13	40582	9504	41483	13339	38264	18665	0	0
2013-14	41597	9348	42351	13193	39865	18371	0	0
Average	40739	9441	41875	13262	38003	18032	0	0
Increase in cost (Per cent)				40		91		

**Table 9: Average cost of production of wheat crop in various salinity classes**

Year	Normal		Slight		Moderate		Severe	
	₹/ha	₹/ha	₹/ha	₹/ha	₹/ha	₹/ha	₹/ha	₹/ha
2010-11	38420	8262	39370	10527	33670	12333	0	0
2011-12	38798	8117	39338	10490	34904	13688	0	0
2012-13	38018	7823	39248	10089	35700	12907	0	0
2013-14	39444	8066	39366	10172	37211	13195	0	0
Average	38670	8065	39331	10316	35371	13021	0	0
Increase in cost (Per cent)				28		61		

**Table 10: Average costs and returns per season by soil salinity classes**

Soil salinity class	Gross return (₹/ha)		Total cost (₹ /ha)		Net return (₹ /ha)	
	<i>Kharif</i>	<i>Rabi</i>	<i>Kharif</i>	<i>Rabi</i>	<i>Kharif</i>	<i>Rabi</i>
Normal	66883	69528	40739	38670	26143	30858
Slight	48941	55281	41875	39331	7066	15951
Moderate	32666	39389	38003	35371	-5337	4018
Severe	0	0	0	0	0	0

**Table 11: Potential and Actual damage caused by soil salinity**

Year	(₹/ha)					
	<i>Kharif</i>		<i>Rabi</i>		Agricultural year	
	Potential damage	Actual damage	Potential damage	Actual damage	Potential damage	Actual damage
2010	6508	5662	3933	3343	10441	9005
2011	6447	5609	4350	3741	10797	9350
2012	6372	5543	4457	3878	10829	9421
2013	6824	5664	4338	3817	11162	9482
Average	6538	5620	4270	3695	10807	9314

### Gross and Net Returns

The gross costs and returns were estimated for both *kharif* (for rice crop) and *rabi* (for wheat crop) seasons separately for each salinity classes (Table 10). The land productivity was estimated as sum of the total *kharif* and *rabi* seasons crop productivities.

Gross returns for both the seasons were decreased across the salinity classes. However, the net returns decreases more sharply than the gross returns because the cost of production remains uniform throughout the salinity classes. In *kharif* season, the net returns from slightly saline land was ₹ 7066 depicting 73 per cent lesser income than normal land, whereas moderate salinity showed a loss of ₹ 5337 per ha. Similarly, in *rabi* season, net income was lower for both slight and moderate saline soils respectively by ₹15951 per ha and ₹ 4018 per ha compare the net income from to normal soils (₹30858 per ha). Thus, net returns decreases more sharply with increasing salinity, indicates the adverse effect of salinity on net income.

### Damage assessment

The land productivity data (Table 10) were used to assess the damage caused by soil salinity. The damage in terms of farm income losses were estimated by subtracting the per ha net income of each soil salinity classes from the net income of the normal class for each crop (Datta and Jong, 2002; Datta *et al.*, 2004; Thimmappa *et al.*, 2014). The potential damage per cultivable area has determined by calculating the weighted average of the damage suffered in all categories of affected land as per Table 2.

The actual farm income losses per ha in *kharif* and *rabi* seasons has been estimated by multiplying potential farm income losses with the corresponding cropping intensities. The average cropping intensities for *kharif*

and *rabi* seasons were 86 per cent each as presented in Table 5. To calculate the actual income loss per hectare, the potential income loss figures for *kharif* and *rabi* seasons were multiplied by the factor 0.86.

The total loss for agricultural year was estimated by summing the losses occurred in both *kharif* and *rabi* seasons (Table 11). The annual potential and actual losses per ha due to soil salinity was ₹10807 and ₹9314 per ha, respectively. So, the total annual monetary loss arises due to soil salinity in the study domain, village Banmandori is ₹3.67 million.

### CONCLUSIONS

Soil salinity is one of the major land degradation problem not only in India, but in the world too. The estimates showed an annual potential and actual losses per ha due to soil salinity was ₹10807 and ₹9314, respectively. So, the total annual monetary loss arises due to soil salinity in village Banmandori is ₹3.67 million, which is one of the salinity affected area in Haryana. The study confirms that the salinity results in a considerable decrease in net returns from crop production, and farmers' income thus affecting the wellbeing of the rural population. In view of doubling farmers' income by 2022, the policy makers has to give more emphasis on land degradation aspects particularly saline soil reclamation which is a major concern of worry by the farmers of Haryana as well as India.

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## Application of Moving Averages: An Empirical Study of Selected Commodity Future Indices

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### ABSTRACT

The present study "Application of Moving Averages: An empirical study of selected commodity future indices" was primarily based on performance of technical indicator such as moving average in four commodity future indices i.e. MCX Comdex, MCX Metal, MCX Agri and MCX Energy. For the purpose of achieving the objectives the data was collected for each trading day for a period of five years. The results revealed that the short term moving averages and medium term moving averages lead to statistically significant positive returns. Also, it has been concluded that most of the positive returns of moving averages were statistically significant. Highest average returns were observed by MCX Energy that is 2.75 per cent, 2.87 per cent and 2.63 per cent respectively in the case of 7DMA, 14 DMA and 21 DMA. But in the case of 50 DMA and 200 DMA, highest average returns were observed by MCX Metal i.e. 3.88 per cent and 2.72 per cent respectively. MCX Comdex generated highest return for 100 DMA i.e. 2.72 per cent.

### Keywords

Commodity, exponential moving average, future indices, simple moving average

### JEL Codes

C80, C88, O16

### INTRODUCTION

Technical analysis uses information about historical price movements, summarized in the form of price charts, to forecast future price trends (Neely, 1997). It is the study of prices in freely traded markets with the intent of making profitable trading or investment decisions (Kirkpatrick & Dahlquist, 2010). It is most widely used by investment professionals as input for trading decisions. Technica or chartist, analysis of financial markets involves providing forecasts or trading advice on the basis of largely visual inspection of past prices, without regard to any underlying economic or 'fundamental' analysis (Taylor, 1992).

#### MCX (Multi Commodity Exchange of India Limited)

MCX is an independent commodity exchange based in India which facilitates online trading and clearing and settlement of commodity futures transactions, thereby providing a platform for risk management. It started its operations in November 2003, operates under SEBI. It offers trading in varied commodity futures. It was world's 6th largest commodity futures exchange in 2015, as per number of contracts traded. The main competitor of

exchange is National Commodity & Derivatives Exchange Ltd. Globally, MCX ranks no. 1 in Silver, No. 2 in Natural gas, No. 3 in Crude oil and gold in futures trading. The highest traded item is Gold. Four commodity future indices are MCX COMDEX, MCX METAL, MCX ENERGY AND MCX AGR I.

MCX COMDEX is India's maiden real-time Composite Commodity Index based on commodity futures prices of an exchange. The constituents of the Index are liquid commodities traded on the Exchange. It is the simple weighted average of the three group indices – MCX AGR I, MCX METAL & MCX ENERGY. The index is a significant barometer for the performance of commodities market and would be an ideal investment tool in commodities market over a period of time.

MCX METAL index includes gold (15.16per cent), silver (4.07per cent), copper (7.56per cent), zinc (3.09per cent), aluminium (2.87per cent), nickel (5.12per cent) and lead (2.13per cent). MCX ENERGY index includes crude oil (35.22per cent) and natural gas (4.78per cent). MCX AGR I index includes Cardamom (2.01per cent), Mentha Oil (3.89per cent), Crude Palm Oil (6.32per cent) and

cotton (7.78per cent).

**Moving Average:** Moving average is widely used indicator in technical analysis that helps smooth out price action by filtering out the noise from random price fluctuations. It is a trend-following or lagging indicator because it is based on past prices. The two basic and commonly used MAs are the simple moving average (SMA), which is the simple average of a security over a defined number of time periods, and the exponential moving average (EMA), which gives bigger weight to more recent prices. Its common applications are to identify the trend direction and to determine support and resistance levels. The MA method is a “led” method; it follows the trends that are developing in the market. The aim of the method is to identify or signal a new trend that is developing in the market, or to signal the end of an old trend (Benzion *et al.*, 2003).

Buy and sell decisions for moving average indicator are made as under:

Buy, if price (t) > MA (t)

Sell, if price (t) < MA (t)

## **METHODOLOGY**

The research methodology adopted to serve the objectives of the study in an effective manner is described as follows:

### **Conceptual Framework**

The main theme of the present investigation has been conceptualized within a framework to avoid a disorder or an ambiguity in the process of conducting the study. The present research is based on objective of testing moving average in future commodity indices. Moving average is the trend following indicator which represents an average of certain body of data that moves through time. Short term simple moving average (7days, 14days), medium term simple moving average (21days, 50days) and long term moving average (100days, 200days) will be applied on each selected commodity future index i.e. MCX Comdex, MCX Metal, MCX Energy and MCX Agri. Signal rules while applying moving average indicator: when closing price is more than moving average then it is a buy signal otherwise a sell signal. This study is based on secondary data. Further return performance was compared with simple buy and hold strategy. Both long and short trades were studied for their profitability.

### **Population and sample Selection**

The population for the study is four commodity future indices namely MCX Comdex, MCX Metal, MCX Agri and MCX Energy. The data of indices was collected from www.mcxindia.com. Study covered five years period. The secondary data consists of daily closing prices of four indices.

### **Methods of data collection**

For the purpose of study, data consisted of daily opening and closing prices (omitting the days when there was no trading) of MCX Comdex, MCX Metal, MCX Energy and MCX Agri over a period of five years.

### **Analysis of data**

Moving average is based on simple averaging formula. Short term simple moving average(7days, 14 days), medium term simple moving average(21 days, 50 days) and long term simple moving average (100 days, 200 days) were calculated for each selected commodity future index. For example, a 7 day simple moving average of closing price was calculated as follows:

$$SMA(7\text{ days}) = \frac{pn + pn-1 + \dots + pn-6}{7}$$

Similarly, 14DMA, 21DMA, 50DMA, 100DMA and 200DMA were calculated and buy and sell signals were generated as follows:

If the price is more than moving average then it is a buy signal otherwise it is sell signal.

After deriving buy and sell signal, returns were calculated on the basis of changes in the buy and sell signals. After that number of trades, length of trades, profit per trade and number of trades were calculated.

After collection of data, tables were constructed and secondary data was analyzed using Mean, Standard deviation, T-test and Anova.

## **RESULTS AND DISCUSSION**

This section contains results and discussions of this empirical study conducted on the basis of methodology described earlier. The analysis of secondary data collected was done to test the validity of moving average indicator on commodity future indices. This section has been divided into following subsections:

### **Tests of Moving average indicator on commodity future indices**

For the completion of objective, simple moving average was applied on daily closing data of selected commodity future indices that is, MCX Comdex, MCX Metal, MCX Energy and MCX Agri.

The perusal of Table1 shows the number of trades, number of whipsaus, returns and length of trade for each DMA of selected commodity future indices i.e. MCX Comdex, MCX Metal, MCX Energy and MCX Agri. For MCX Comdex, maximum and minimum returns were observed by 100 day moving average(65.32per cent) and 21 day moving average (-3.41per cent) respectively. Percentage of number of positive returns (75.94 per cent) was highest in the case of 7 day moving average with lowest percentage of whipsaus (24.06 per cent).In the case of MCX Metal, maximum and minimum returns were observed by 200 days moving average (38.53 per cent) and 100 day moving average (-31.22 per cent) respectively. Highest percentage of number of positive returns was observed in 50 day moving average (88.31 per cent) with minimum percentage of whipsaus (11.69per cent). Similarly, for MCX Agri, maximum return was observed by 50 days moving average (31.15 per cent) and minimum by 200day moving average i.e. -17.28per cent. Also, maximum whipsaus were observed by 200 day moving average (71.4 per cent). For MCX Energy, maximum and minimum returns were observed by 50 days moving average (89.52per cent) and 100 day moving

Table 1: No of trades, returns and whipsaus for each DMA

Type of DMA	No. of trades	Max return per cent	Min return per cent	No. of positive returns (per cent)	No. of Whipsaus (per cent)
<b>MCX Comdex</b>					
7	266	31.23	-3.40	202 (75.94)	64 (24.06)
14	166	27.56	-2.61	122 (73.49)	44 (26.51)
21	149	36.22	-4.31	100 (67.11)	49 (32.89)
50	83	52.49	-4.07	55 (66.27)	28 (33.73)
100	49	65.32	-3.59	8 (16.33)	41 (83.67)
200	38	36.42	-2.23	13 (34.21)	25 (65.79)
<b>MCX Metal</b>					
7	305	27.48	-7.49	170 (55.74)	135 (44.26)
14	184	25.21	-3.12	119 (64.67)	65 (35.33)
21	140	17.85	-20.68	63 (45.00)	77 (55.00)
50	77	35.01	-3.46	68 (88.31)	9 (11.69)
100	75	7.79	-31.22	50 (66.67)	25 (33.33)
200	28	38.53	-2.17	21 (75.00)	7 (25.00)
<b>MCX Agri</b>					
7	275	21.59	-15.26	202 (73.40)	73 (26.50)
14	159	24.55	-16.36	112 (70.40)	47 (29.50)
21	141	26.08	-16.39	47 (33.30)	94 (66.66)
50	65	31.15	-6.90	32 (49.20)	33 (50.80)
100	42	28.36	-17.22	16 (38.09)	26 (62.00)
200	35	15.05	-17.28	10 (28.60)	25 (71.40)
<b>MCX Energy</b>					
7	165	29.37	-4.56	117 (70.90)	48 (29.09)
14	202	42.66	-5.79	136 (67.33)	66 (32.67)
21	165	29.37	-4.56	117 (70.91)	48 (29.09)
50	105	89.52	-3.73	66 (62.86)	39 (37.14)
100	70	53.59	-6.59	27 (38.57)	43 (61.43)
200	30	24.09	-3.45	8 (26.67)	22 (73.33)

average (-6.59per cent) respectively. 70.91 per cent, highest observed percentage of total trades was positive trades and rest were whipsaus.

Consider the following null hypothesis for moving average indicator:

H<sub>01</sub>: Moving average for each commodity index doesnot lead to positive return.

H<sub>11</sub>: Moving average for each commodity index leads to positive return.

H<sub>02</sub>: Moving average doesnot lead to positive return.

H<sub>12</sub>: Moving average leads to positive return

If p-value < 0.05 then result is significantly different from zero and accept the null hypothesis.

If p-value > 0.05 then result is not significantly different from zero and reject the null hypothesis.

Table 2 represented the average return, standard deviation, t- values and p-values for all type of DMA. For MCX Comdex, 7 day, 14 day, 21 day and 50 day moving averages lead to statistically significant positive returns. But, 100 day and 200 day moving averages do not lead to statistically significant returns. Similarly for MCX Metal, returns were statistically significant in the case of 7 day,

14 day, 50 day and 200 day moving averages. For, MCX Agri, 7 day, 14 day and 50 day moving average lead to statistically significant returns and for MCX Energy, 7 day, 14 day, 21 day, and 50 day moving average lead to positive return.

Table 3 revealed the average return and standard deviation for four types of commodity indices i.e. Comdex, Metal, Energy and Agri by applying various moving averages. 7 day moving average leads to statistically significant positive returns for all four commodity indices. Highest average return has been observed for MCX Energy (2.75per cent). In the case of 14 day moving average and 21 day moving average also, MCX Energy lead to highest statistically significant average returns (2.87and 2.63per cent). Other indices have also lead to statistically significant average returns except MCX Metal of 21 day moving average which does not lead to positive return. 50 day, 100 day and 200 day moving average does not lead to statistically significant returns for all four commodity indices.

### DISCUSSION

There were certain studies which were not in favor of use of technical analysis to get abnormal returns. Dunis &

**Table 2: Performance of moving average for each commodity index**

Type of DMA	Average return per cent	t-value	p-value	f-value	p-value
<b>MCX Comdex</b>					
7	2.06 (3.68)	9.120	0.000	0.274	0.928
14	2.32 (3.95)	7.586	0.000		
21	2.29 (5.11)	5.468	0.000		
50	2.66 (7.36)	3.297	0.001		
100	2.84 (13.2)	1.505	0.139		
200	2.72 (9.14)	1.833	0.075		
<b>MCX Metal</b>					
7	0.67 (3.18)	3.668	0.000	15.005	0.000
14	1.90 (3.81)	6.772	0.000		
21	-0.11 (4.15)	-0.314	0.754		
50	3.88 (6.91)	4.924	0.000		
100	-0.86 (6.04)	-1.231	0.222		
200	4.57 (9.94)	2.434	0.000		
<b>MCX Agri</b>					
7	1.01 (3.16)	5.274	0.000	1.065	0.379
14	1.07 (4.32)	3.129	0.002		
21	0.39 (4.38)	1.050	0.296		
50	1.80 (6.66)	2.181	0.033		
100	1.05 (7.57)	0.897	0.375		
200	0.34 (5.22)	0.385	0.703		
<b>MCX Energy</b>					
7	2.75 (5.73)	6.219	0.000	1.054	0.384
14	2.87 (6.40)	6.374	0.000		
21	2.63 (5.36)	6.308	0.000		
50	3.30 (11.95)	2.832	0.006		
100	1.59 (7.88)	1.689	0.096		
200	0.48 (5.53)	0.472	0.641		

Figures in parentheses are Standard errors

**Table 3: Commodity-wise performance of moving averages**

Type of index	Average return per cent	f-value	p-value
<b>7 Day Moving Average</b>			
Comdex	2.06 (3.67)	14.056	0.000
Metal	0.67 (3.18)		
Energy	2.75 (5.73)		
Agri	1.01 (3.16)		
<b>14 Days Moving Average</b>			
Comdex	2.32 (3.95)	4.356	0.005
Metal	1.90 (3.81)		
Energy	2.87 (6.40)		
Agri	1.07 (4.32)		
<b>21 Days Moving Average</b>			
Comdex	2.29 (5.11)	12.000	0.000
Metal	-0.11 (4.15)		
Energy	2.63 (5.36)		
Agri	0.39 (4.38)		
<b>50 Days Moving Average</b>			
Comdex	2.66 (7.36)	0.724	0.538
Metal	3.88 (6.91)		
Energy	3.30 (11.95)		
Agri	1.80 (6.66)		
<b>100 Days Moving Average</b>			
Comdex	2.84 (13.23)	1.962	0.120
Metal	-0.86 (6.04)		
Energy	1.59 (7.88)		
Agri	1.05 (7.57)		
<b>200 Days Moving Average</b>			
Comdex	2.72 (9.14)	2.071	0.107
Metal	4.57 (9.94)		
Energy	0.48 (5.53)		
Agri	0.34 (5.23)		

Figures in parentheses are Standard errors

Miao (2007) showed that after inclusion of transaction costs, the simple carry model performs much better than the benchmark MACD model in terms of annualized return, risk-adjusted return and maximum potential loss.

Another study exhibited that technical analysis does not work as well as it used to, Sewell (2007) reviewed the literature on technical analysis and found out that there was evidence in support of the usefulness of moving averages, momentum, support and resistance and some patterns. He further found out that technical analysis works best for currency market, intermediate on futures markets, and worst on stock markets and chart pattern works better on stock market than currency market. There is evidence in support of the usefulness of moving averages, momentum, support and resistance and some patterns; but no convincing evidence in support of Gann Theory or Elliott Wave Theory. Non-linear methods work best overall.

There were studies which were in favor of use of

technical analysis to get abnormal returns like Vasiliou *et al.* (2006) investigated the performance of various technical trading rules in Athens stock market. They test two of the simplest and most popular trading rules-Moving Averages and MACD indicators and evaluated how these simple forms of technical analysis can predict stock price movements in Athens Stock Exchange. Overall, results provided strong support for the examined technical strategies. Another study by Wong *et al.* (2003) focused on the role of technical analysis in signaling the timing of stock market entry and exit. Test statistics were introduced to test the performance of the most established of the trend followers, the moving average, and the frequently used counter trend indicator, the relative strength index. It was found that member firm of Singapore Stock Exchange tend to enjoy substantial profits by applying technical indicators.

### CONCLUSIONS

From the analysis performed in current study, following conclusions can be drawn:

- By comparing the moving average wise returns, it was observed that short term moving averages and medium term moving average (7DMA, 14 DMA and 21 DMA) lead to statistically significant positive returns. Therefore, short term moving averages are more useful for determining the results and helpful in making decisions.
- MCX Energy generated highest average returns for 7DMA, 14 DMA and 21 DMA i.e. 2.75 per cent, 2.87 per cent and 2.63 per cent respectively.
- For 50 DMA and 200 DMA, highest average returns were observed by MCX Metal i.e. 3.88 per cent and 2.72 per cent respectively.
- For 100 DMA, maximum average return was generated by MCX Comdex i.e. 2.72 per cent.
- By using moving average indicator, MCX Comdex was giving statistically significant positive returns with 7DMA, 14DMA, 21DMA and 50DMA.
- MCX Metal leads to statistically significant positive returns with 7DMA, 14DMA, 50DMA and 200DMA, MCX Energy 7DMA, 14DMA, 21DMA and 50DMA and MCX Agri with 7DMA, 14DMA and 50DMA. Other indices have also lead to statistically significant average returns except MCX Metal of 21 day moving average which does not lead to positive return.
- 50 day, 100 day and 200 day moving average does not lead to statistically significant returns for all four commodity indices.

Present Study can be extended to explore a number of issues. Few suggestions in this regard have been listed below:

The study has been conducted for period of five years only. It is suggested to study for more number of years to get clear picture about moving average indicator.

The present study was conducted on four commodity

future indices. To carry the study further, a comparison can be made to see whether there is any significant difference in the returns of stocks and indices.

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## Impact of National Rural Health Mission (NRHM) on Women Health-A Study of Jalandhar District

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### ABSTRACT

The study conducted on 120 beneficiaries of NRHM to assess the role of NRHM led to conclusion that most of the respondents belonged to Schedule Caste category. Beside the pregnancy large number of women respondents was suffering from anaemia, heart problem, hypertension allergy etc. The study showed that nearly one-third of the respondents go for their check-up during pregnancy in private hospitals. Most of the respondents also informed that they did not get free provision of blood during surgery under JSSK scheme of NRHM. Availability of less doctors, Para-medical staff and low ambulance at the time of delivery were the main problems found during study.

### Keywords

ANM, ASHA, health, JSSK, JSY, NRHM, pregnancy

### JEL Codes

A14,C82, D54, D86, Z13

### INTRODUCTION

Health is regarded as a priority for sustained development at the individual, community and national levels. Improved health is a part of total socio-economic development and is regarded as an index of social development. India is a traditional country, where women are respected as *Matrishakti* (Kushwah, 2013). Health care access is important for women as women body changes throughout her life time, from foetal development to post menopause. Though health is used to be consider as one of the important issue in our society, yet the women were largely neglected due to the prevailing socio cultural patterns in the society (Dwaraknath, 2012). Complementing good health, every country should aim at achieving the well-being of its citizens. Well-being is a more pragmatic approach to health and life, which encompasses mental, physical, cultural, and spiritual health and is of the utmost importance in achieving positive life outcomes (Maity *et al.*, 2016). Right from 1952 till date there has been a long list of various programmes planned and implemented for improving the health of people in general and of women and children in particular. After experiencing the various issues of the health matter and emerging new challenges

on this front, the government of India started ambitious health programme in April, 2005 which is popularly known as National Rural Health Mission (NRHM) (Ram *et al.*, 2009; Hazra, 2012; Patel, 2012. The huge surge in service delivery in public health institutions indicates the enhanced public confidence in public health system. Under the National Rural Health Mission (NRHM) which was launched by the Government of India in 2005, introduced a special and focused scheme called Janani Suraksha Yojana (JSY) with the objective of reducing maternal and infant mortality (Deshpande, 2011). The maternal mortality in India declined from 254 during 2004- 2006 to 230. In Punjab the maternal mortality ratio is 172/1, 00,000 live births. Janani Shishu Suraksha Karayakaram (JSSK) a new scheme is launched by government in 2011. Under this scheme all women delivering in public health institutions will have absolutely free of cost services including medicines, food, diagnostic, free transport from home and back and even blood if required. Given the importance of health in the life of an individual, this study was conducted to examine the socio-economic profile of beneficiaries of NRHM and to assess the role of NRHM on the health of rural women.

## DATA AND METHODOLOGY

The paper is based on the primary data collected from Jalandhar district in Punjab. Two blocks from Jalandhar district were selected under the study. Phillaur and Jalandhar West block were selected and from each block four villages were selected further fifteen respondents from each village were selected. Thus, a total sample comes out as 120. A purposive sampling design was used to select the respondents (women) who availed the benefit of NRHM. Beneficiaries of NRHM were procured from Sub-centres, Primary Health Centres (PHC), and Community Health Centres (CHC). The data was collected from the respondents by using interview schedule and analyzed with the help of statistical tools such as frequency tables and percentages.

## RESULT AND DISCUSSION

The data given in Table 1 revealed the social category of the respondents under the study. Majority of the respondents (55.83 per cent) belonged to the Scheduled Caste (SC) followed by the Other Backward Class (OBC) which constituted 35 per cent of the total respondents. Almost 9 per cent of the respondents belonged to the general caste. Results indicated that most of the respondents belonged to the Schedule Caste category.

**Table 1: Distribution of respondents on the basis of social category**

Social category	Phillaur (n <sub>1</sub> =60)	Jalandhar west (n <sub>2</sub> =60)	Total (N=120)
Scheduled caste (SC)	31 (51.67)	36 (60.00)	67 (55.83)
Other backward caste (OBC)	24 (40.00)	18 (30.00)	42 (35.00)
General	5 (8.33)	6 (10.00)	11 (9.17)
Total	60 (100)	60 (100)	120 (100.00)

Figures in parentheses indicates percentages

### Age at Marriage

The risk of maternal mortality is the highest for adolescent girls under 15 years old. Complications in pregnancy and childbirth are the leading cause of death among adolescent girls in most developing countries, including India (Mahajan & Sharma, 2014). Age is a factor that affects the behaviour of the people. Persons belonging to different age groups normally internalize different values according to the traditional roles and changing needs of the society. The data (Table 2) indicated that out of total sample, nearly half of (42.50 per cent) respondents were married in the age group of 18 to 22 years, whereas 24.17 per cent respondents were married in age group of 23 to 26 years. About 10 per cent of the respondents married below the age of 18 and a few (1.67 per cent) of respondents married at age above 34

**Table 2: Distribution of respondents on the basis of their age at marriage**

Age	Phillaur (n <sub>1</sub> =60)	Jalandhar West (n <sub>2</sub> =60)	Total (N=120)
Upto 18	7 (11.67)	5 (8.33)	12 (10.00)
19-22	29 (48.33)	22 (36.67)	51 (42.50)
23-26	19 (31.67)	10 (16.66)	29 (24.17)
27-30	2 (3.33)	15 (25.00)	17 (14.17)
31-34	2 (3.33)	7 (11.67)	9 (7.50)
Above 34	1 (1.67)	1 (1.67)	2 (1.66)
Total	60 (100.00)	60 (100.00)	120 (100.00)

Figures in parentheses indicates percentages

years. The data indicated that most of the women respondents were married in the age group of 18-26 years.

### Education

Education makes a person capable of playing a responsible role as a citizen and member of family and society. It is also a key factor in creating awareness about one's environment and the society. The data in Table 4 highlighted that about one fourth of the respondents (25 per cent) were educated up to primary level whereas 23.33 per cent were educated up to middle level. About 19.17 per cent of the respondents were educated up to senior secondary level followed by only one of the respondents educated up to Graduation. Overall data showed that education level among women was low.

**Table 3: Distribution of respondents according to their education**

Educational level	Phillaur (n <sub>1</sub> =60)	Jalandhar West (n <sub>2</sub> =60)	Total (N=120)
Illiterate	7 (11.67)	5 (8.33)	12 (10.00)
Primary	17 (28.33)	13 (21.67)	30 (25.00)
Middle	19 (31.67)	9 (15.00)	28 (23.33)
Matric	11 (18.33)	15 (25.00)	26 (21.67)
Sen. Secondary	6 (10.00)	17 (28.33)	23 (19.17)
Graduate	-	1 (1.67)	1 (0.83)
Total	60 (100)	60 (100)	120 (100)

Figures in parentheses indicates percentages

**Table 4: Distribution of respondents according to their occupation**

Occupation	Phillaur (n <sub>1</sub> =60)	Jalandhar West	Total (N=120)
Permanent Labour	17 (28.33)	12 (20.00)	29 (24.17)
Casual Labour	12 (20.00)	5 (8.33)	17 (14.16)
Service (Private/Public)	4 (6.67)	25 (41.67)	29 (24.17)
Housewives	27 (45.00)	18 (30.00)	45 (37.50)
Total	60 (100)	60 (100)	120 (100)

Figures in parentheses indicates percentages

### Occupation

Occupation is one of the important features of economic life. Which helps to sustain the human beings Table 5 showed that 37.5 per cent were housewives whereas 24.17 per cent each engaged in permanent labour and services. More than one ten 14.16 per cent of the respondents were casual labourers in the area of study. Overall data showed that large number of respondents were housewives.

**Table 5: Distribution of respondents on the basis of their Annual income 2014-15**

Annual income (₹)	Phillaur (n <sub>1</sub> =60)	Jalandhar West (n <sub>2</sub> =60)	Total (N=120)
Upto 60,000	10 (16.67)	7 (11.67)	17 (14.17)
60,001 to 80,000	8 (13.33)	3 (5.00)	11 (9.17)
80,001 to 100000	13 (21.67)	4 (6.66)	17 (14.16)
100001 to 1,20,0000	21 (35.00)	24 (40.00)	45 (37.50)
1,20,0001 to 1,40,0000	3 (5.00)	6 (10.00)	9 (7.50)
Above 1,40,0001	5 (8.33)	16 (26.67)	21 (17.50)
Total	60 (100)	60 (100)	120 (100)

Figures in parentheses indicates percentages

### Annual Income

Income level of the person determines one's social and economic status in the society. Income as socio-economic variable is very important indicator as it describes the status and living standard of the family. About 37.50 per cent of the respondents had their total annual income between ₹100001 to ₹1, 20,000 while 17.50 per cent of the respondents had annual income above ₹1, 40,001, included with 26.67 per cent from Jalandhar west where it

was just 8.33 per cent in Phillaur respondents. On the whole it is observed that more than one-third (37 per cent) of the respondents of the area under study had their total annual income below ₹1,20,000 per annum. It was revealed from the data that respondents from Jalandhar west had better economic status than Phillaur respondents annual income.

### Information about Health Centre

Efforts are being made by the government to provide better infrastructure facilities to improve the primary health and community health services in rural areas. In the Indian health scenario, sub-centre (SC) is a bridge between rural community and public primary health care system. A sub centre is responsible for providing all primary health care and makes the services more responsive and sensitive for the rural community (Mahajan and Sharma 2014). Table 7 showed the availability of basis facilities at government health centres. About half of the respondents i.e. (50.83 per cent) found a condition of health centre is good and about 24.17 per cent of respondents said that board display on health centre is in prominent local language. Out of total respondents majority of respondents i.e. 83.33 per cent reported that there is availability of drinking water, 54.17 per cent reported regular electricity at health centre and 65 per cent reported about the availability of toilet facilities, whereas availability of beds, basic equipment was found inadequate. In context of transport facility, data indicated very poor per cent that only 2.50 per cent reported about availability of ambulance. While 89 per cent of respondents said communication facilities i.e. landline, internet was not available at health centres. Overall data showed that there was less basic facility, insufficient of beds, inadequate transportation

### Visit to health centre

Table 8 revealed that out of those respondents who visited the government health centre more than one third, i.e. 38.33 per cent visited primary health centre (PHC) or community health centre (CHC) at block level. About 26.67 per cent of the respondents visited the sub centre in there village. It was found during data collection that though many of the respondents visited the sub centre advised to visit the PHC at block level by the Para-medical staff but due to financial constraint, laziness or carelessness they did not do so.

In case of private health centres nearly half (42 per cent) of respondents preferred to take treatment from nursing homes followed by 36.67 per cent of respondents who visited private hospital and majority 80.83 per cent of the respondents went to chemist during illness depends upon how serious illness is. But it was interesting to know that none of respondent relied on non-institutional source of treatment like *dera/mazar*.

### Facilities under National Rural Health Mission (NRHM)

National Rural Health Mission (NRHM) by the Government of India with the objective of providing

**Table 6: Distribution of respondents on the basis of information about health centre**

<b>Particular</b>	<b>Phyllaur (n<sub>1</sub>=60)</b>	<b>Jalandhar West (n<sub>2</sub>=60)</b>	<b>Total (N=120)</b>
<b>Infrastructure facilities</b>			
Good conditions of buildings	23 (38.33)	38 (63.33)	61 (50.83)
Prominent display board in local language	10 (16.67)	19 (31.67)	29 (24.17)
Record maintained properly	52 (86.67)	48 (80.00)	100 (83.33)
Availability of drinking water	38 (63.33)	41 (68.33)	79 (65.83)
Availability of toilets	43 (71.67)	35 (58.33)	78 (65.00)
Availability of regular electricity	23 (38.33)	42 (70.00)	65 (54.17)
Dispensary building is disabled friendly	12 (20.00)	6 (10.00)	18 (15.00)
Availability of sufficient beds	8 (13.33)	18 (30.00)	26 (21.67)
Availability of ambulance Sub-centre/Public Health Centre (SC/PHC)	2 (3.33)	1 (1.67)	3 (2.50)
Existence of registration counter	16 (26.67)	9 (15.00)	25 (20.83)
Sufficient sitting arrangement for Patients	33 (55.00)	39 (65.00)	72 (60.00)
Basic equipment available	13 (21.67)	25 (41.67)	38 (31.67)
First aid management	42 (70.00)	53 (88.33)	95 (79.17)
Area of sub centre sufficient	8 (13.33)	11 (18.33)	19 (15.83)
Good communication facilities	8 (13.33)	5 (8.33)	13 (10.83)

effective healthcare facilities to the rural population and promoting quality infrastructure, especially among backward regions, keeping the main focus on improving infant, child and maternal health conditions. So there are various schemes under NRHM. The table 9 showed the different schemes facilities received by the respondents, all of the respondents had taken facilities of Janani Suraksha Yojana (JSY) as well Immunization. While 42.50 per cent of the respondents got the facilities of Janani Shishu Suraksha Karyakaram (JSSK) followed by half (50.80 per cent) of the respondents go for fam.

#### **Diseases**

Table 10 revealed that the health problems from which respondents were suffering. Large number of respondents i.e. 83 reported that they had suffered from Anaemia, followed by 75 per cent suffered from hypertension.

While 65 per cent of the respondents suffered from Typhoid and 63.33 per cent of the respondents suffered from Diabetes. Further 57.50 per cent of the respondents told that they suffered from joint problem while 49.17 suffered from allergy. The other health problem from which the respondents suffered were include Urinary Tract Infection (46.67 per cent), Heart problem (33.33 per cent), Malaria (22.50 per cent), Tuberculosis (15.83 per cent) and some other problems i.e. Malnutrition, Epilepsy and Arthritis. So there were certain common health problems like Anaemia, Heart problem and Hypertension which were mentioned by a large proportion of the respondents. The growing burden of disease both of communicable and non-communicable diseases can be reduced through prevention and behaviour change communication initiatives that creative, compelling,

**Table 7: Distribution of respondents on the basis of their visit to health centre during illness**

Health Institution	Phillaur (n <sub>1</sub> =60)	Jalandhar West (n <sub>2</sub> =60)	Total (N=120)
Public Health Centre and Community Health Centre Sub-Centre	22 (36.67)	12 (20.00)	34 (28.33)
Private hospital	11 (18.33)	21 (35.00)	32 (26.67)
Nursing Home	12 (20.00)	32 (53.33)	44 (36.67)
Chemist shop	15 (25.00)	35 (58.33)	50 (41.67)
	45 (75.00)	52 (86.67)	97 (80.83)

Figures in parentheses indicate percentages. Percent exceed 100 due to multiple responses

**Table 8: Distribution of respondents on the basis of facilities received under National Rural Health Mission (NRHM) family planning, because of their complexity during delivery**

Particular	Phillaur (n <sub>1</sub> =60)	Jalandhar West (n <sub>2</sub> =60)	Total (N=120)
Jnani Surksha Yojana (JSY)	60 (100.0)	60 (100.0)	120 (100.0)
Janani Shishu Suraksha Karyakram (JSSK)	28 (46.7)	23 (38.3)	51 (42.5)
Immunization	60 (100.0)	60 (100.0)	120 (100.0)
Family planning	29 (48.3)	32 (53.3)	61 (50.8)
Any other*	8 (13.3)	2 (3.3)	10 (8.3)

\*Tuberculosis, malaria, dengue, etc

based on evidence, done professionally and leverages partnership and monitored, tracked and evaluated for their attribution and contribution to the positive change in health seeking behaviours as well as adoption of desirable health practices (Kumar 2016).

**Information about Janani Suraksha Yojana (JSY)**

One of the success stories being attributed to NRHM is a huge increase in institutional deliveries the number of beneficiaries under JSY had increased from 7 lakhs in 2005-2006 to over 86 lakhs in 2008-2009 in India (Nandan 2010). The table 4.2.10 highlighted the information about JSY. About 83.33 per cent of the respondents reported that ASHA workers were the main source of information about JSY, followed by 41.67 per cent reported that AMN as their source of information. Further, 41.67 per cent got information about JSY from

**Table 9: Distribution of respondents on the basis of health problem from which they suffer**

Diseases	Phillaur (n <sub>1</sub> =60)	Jalandhar West (n <sub>2</sub> =60)	Total (N=120)
Malaria	11 (18.33)	16 (26.67)	27 (22.50)
Typhoid	36 (60.00)	42 (70.00)	78 (65.00)
Anaemia	52 (86.67)	48 (80.00)	100 (83.33)
Arthritis	2 (3.33)	1 (1.67)	3 (2.50)
Joint problem	56 (93.33)	13 (21.67)	69 (57.50)
Allergy	23 (38.33)	36 (60.00)	59 (49.17)
Hypertension	42 (70.00)	48 (80.00)	90 (75.00)
Diabetes	43 (71.67)	33 (55.00)	76 (63.33)
Tuberculosis	11 (18.33)	8 (13.33)	19 (15.83)
Malnutrition	7 (11.67)	2 (3.33)	9 (7.50)
Urinary Tract Infection	38 (63.33)	18 (30.00)	56 (46.67)
Heart Problem	17 (28.33)	23 (38.33)	40 (33.33)
Epilepsy	4 (6.67)	1 (1.67)	5 (4.17)

Figures in parentheses indicate percentages. Percent exceed 100 due to multiple responses

fellow villagers comprising village friends, neighbour etc. More than half (above 60 per cent) of respondents reported that their name was registered under JSY as well as their check-up card maintain by ANM whereas 35.83 per cent they got registered with the help of ASHA worker. Out of total 44.17 per cent of the respondents told that they go for check up with other sources i.e. husband, mother-in-law, relatives etc. while about 20 per cent of the respondents told that they go for check up with AWW and ASHA workers. Nearly one third of the respondents go for their check up in private hospitals while majority of the respondents go for their health check-up in government health centre.

**Janani Shishu Suraksha Karyakaram (JSSK)**

Building on JSY, another major initiative 'Janani Shishu Suraksha Karyakram' was launched in June 2011 to eliminate out-of-pocket expenditure for pregnant women and sick neonates. This initiative entitles every woman delivering in a public health institution to free drugs, diagnostics and diet, besides transportation (Gupta 2013)

Table 12 depicted that large number 82 per cent of the respondents get free treatment under JSSK while 33.34

**Table 10: Distribution of respondents on the basis of their information about Janani Suraksha Yojana (JSY)**

Particulars		Phillaur (n <sub>1</sub> =60)	Jalandhar West (n <sub>2</sub> =60)	Total (N=120)
Source of Information <sup>#</sup>	Accredited Social Health Activist Worker (ASHA)	48 (80.00)	52 (86.67)	100 (83.33)
	Auxiliary Nurse Midwives (ANM)	31 (51.67)	19 (31.67)	50 (41.67)
	Anganwadi Worker (AWW)	3 (5.00)	11 (18.33)	14 (11.67)
	Fellow Villagers	19 (31.67)	31 (51.67)	50 (41.67)
	Accredited Social Health Activist Worker (ASHA)	10 (16.67)	33 (55.00)	43 (35.83)
	Auxiliary Nurse Midwives (ANM)	48 (80.00)	24 (40.00)	72 (60.00)
	Anganwadi Worker (AWW)	2 (3.33)	3 (5.00)	5 (4.17)
	<b>Total</b>	60 (100.00)	46 (76.67)	120 (100.00)
	Accredited Social Health Activist Worker (ASHA)	15 (25.00)	22 (36.67)	37 (30.83)
	Auxiliary Nurse Midwives (ANM)	45 (75.00)	38 (63.33)	83 (69.17)
<b>Total</b>	60 (100.00)	60 (100.00)	120 (100.00)	
Go for Check-up under this scheme with	Accredited Social Health Activist Worker (ASHA)	10 (16.67)	8 (13.33)	18 (15.00)
	Anganwadi Worker (AWW)	19 (31.66)	6 (10.00)	25 (20.83)
	Auxiliary Nurse Midwives (ANM)	9 (15.00)	15 (25.00)	24 (20.00)
	Any Other <sup>A</sup>	22 (36.67)	31 (51.67)	53 (44.17)
	<b>Total</b>	60 (100.00)	60 (100.00)	120 (100.00)
Place of Check Up <sup>#</sup>	Sub-centre (SC)	15 (25.00)	-	15 (12.50)
	Public Health Centre (PHC)	40 (66.67)	12 (20.00)	52 (43.33)
	Community Health Centre (CHC)	20 (33.33)	26 (43.33)	46 (38.33)
	Private hospital	10 (16.67)	32 (53.33)	42 (35.00)

<sup>#</sup> Multiple response <sup>A</sup> includes husband, mother-in-law, relatives etc.  
Figures in parentheses indicates percentages

per cent reported that they paid some amount for treatment. About 70.59 per cent of the respondents received iron medicine during treatment and 47.06 per cent of the respondents get both medicine iron as well as calcium free of cost while no other supplement received by respondents during treatment. In complex delivery respondents admitted in hospital for treatment, more than half of the respondents (52.94 per cent) had admitted 7 to 9 days in hospital whereas 25.49 per cent of the

respondents admitted more than 9 days in hospital. The provision of free diet during stay in hospital was given to women and child, about 27.45 per cent of the respondents received free diet during the stay in hospital. Out of total 29.41 per cent of the respondents said they not received free diet during treatment days. Only 11.76 per cent of the respondents reported about the provision of free blood. As there is referral transport from home to hospital facility, facility to facility (in case of

**Table 11: Distribution of respondents on the basis of facilities received under Janani Shishu Suraksha Karyakaram (JSSK)**

Particulars		Phillaur (n <sub>1</sub> =60)	Jalandhar West (n <sub>2</sub> =60)	Total (N=120)
Free Treatment	Yes	16 (57.15)	18 (78.27)	64 (82.36)
	No	12 (42.85)	5 (21.73)	17 (33.34)
	Total	28 (100.00)	23 (100.00)	51 (100.00)
Free Medicine <sup>#</sup>	Iron	22 (78.57)	14 (60.87)	36 (70.59)
	Calcium	21 (75.00)	15 (65.22)	36 (70.59)
	Both	14 (50.00)	10 (43.48)	24 (47.06)
Admit Duration	Upto 5	3 (10.71)	1 (4.35)	4 (7.84)
	5-7	4 (14.29)	3 (13.05)	7 (13.73)
	7-9	16 (57.14)	11 (47.83)	27 (52.94)
	Above 9	5 (17.86)	8 (34.78)	13 (25.49)
	Total	28 (100.00)	23 (100.00)	51 (100.00)
Free Diet During stay in hospital	Not received	12 (42.86)	3 (13.04)	15 (29.41)
	Upto 5	3 (10.71)	1 (4.35)	4 (7.84)
	5-7	2 (7.14)	3 (13.04)	5 (9.80)
	7-9	6 (21.43)	8 (34.78)	14 (27.46)
	Above 9	5 (17.86)	8 (34.78)	13 (25.49)
	Total	28 (100.00)	23 (100.00)	51 (100.00)
Diet Satisfaction	Good	10 (35.71)	3 (13.04)	13 (25.49)
	Average	6 (21.43)	2 (8.70)	8 (15.69)
	Poor	12 (42.86)	18 (78.26)	30 (58.82)
	Total	28 (100.00)	23 (100.00)	51 (100.00)
Free blood provision	Yes	2 (7.14)	4 (17.39)	6 (11.76)
	No	26 (92.86)	19 (82.61)	45 (88.24)
	Total	28 (100.00)	23 (100.00)	51 (100.00)
Received Ambulance facilities	Yes	5 (17.86)	2 (8.70)	7 (13.73)
	No	23 (82.14)	21 (91.30)	44 (86.27)
	Total	28 (100.00)	23 (100.00)	51 (100.00)

<sup>#</sup> Multiple response; Figures in parentheses indicates percentages

complication) and facility to home are being provided free under JSSK but only 13.73 per cent of the respondents received ambulance facilities while 86.27 per cent of the respondents not received.

#### **CONCLUSIONS**

India is passing through a period of transition in its own development path. The new National Health policy should be visionary in its approach to fulfil the objective of economic development, social inclusion and environmental sustainability and at the same time be practical in goal setting and providing financial, technical and administrative support to achieve those goals. Both socio-economic and demographic factors shown a great influence use of health care services, socio-economic conditions and cultural constrains are major determinants of poor maternal health-care coverage. Improved access to government health services, which are used primarily by the poor and the disadvantaged sections of the society, will go a long way in achieving better health outcomes. For effective planning and implementation of public health program, we require a health care delivery system with defined responsibilities of a defined area of operation, trained manpower and effective public health legislation. Proper health information campaigns should be held in villages to aware the people particularly women's in rural areas. Efforts are being made by government to provide better infrastructure facilities to improve the primary health and community health services in rural areas.

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## **Work Life Balance among Executives in Manufacturing Sector in Ludhiana**

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### **ABSTRACT**

*Determining the Work life balance (WLB) of employees is an important consideration for employers interested in improving employee's contribution towards work. The purpose of this research was to investigate the work life balance among executives in manufacturing sector in Ludhiana. Seven WLB variables were namely self, family, technology, leisure, money, change and time management were examined. The results showed the level of work life balance and the practices followed by employees and management to improve work life balance among executives. According to the findings of the research, the achievement of better work-life balance can yield dividends for employers in terms of: having a more motivated, productive and less stressed workforce that feels valued; attracting a wider range of candidates, such as older part-time workers; increased productivity and reduced absenteeism; gaining the reputation of being an employer of choice; retaining valued employees; achieving reduced costs; and maximizing available labour.*

### **Key words**

Executives, job insecurity, time pressure, work life balance

### **JEL Codes**

J00, J28, L0, L60, M00

### **INTRODUCTION**

In the modern times of stresses and strains, there is an urgent need to strike a balance between work and life. Work-life balance includes proper prioritizing between "work" which includes career and ambition and "lifestyle" which includes health, pleasure, leisure, family and spiritual development/meditation. This relates to the idea of lifestyle choice.

Work-life balance is the term used to describe those practices at workplace that recognize and aim to support the employee's need to achieve a balance between the demands of work and family life. It is achieved when an individual's right to a fulfilled life inside and outside paid work is accepted and respected as the norm, to the mutual benefit of the individual, business and society. The concept of work-family life balance came from the fact that an individual's work-life and personal/family life may exert conflicting demands on each other (Pandey, 2014). Catsouphes *et al.* (2007) stated that the effectiveness of work-life balance policies and programs of the employers could be enhanced by assessing the

extent of employees' demands for work life integration, the availability of needed resources, and the effectiveness of adaptive strategies and tactics that employees could use at home, at work, and in the community to fulfil their work and personal responsibilities. Today with increasing demands at work place, the interface between work life and personal life assumed significance which demands more attention. The pressures of the work or personal life can lead to stress. According to studies, it has been found that such situation affects person's health both physiologically and psychologically. Therefore, it is important for employees to maintain a healthy balance between work and their private lives.

The work life balance is the individual perception that work and non-work activities are compatible and promote growth in accordance with an individual's current life priorities. Supriya & Doble (2010) highlighted Work-Life Balance across genders and found that both men and women are experiencing work life imbalance. Though after liberalization, many Indian organizations have been introducing various Work-Life

Balance practices like flexi times, part time work, and provision for child care facilities which are facilitated in various developed countries it is found that imbalance still exist among men and women in every organization. Panchanatham (2011) revealed that role overload, dependent care issues, quality of health, problems in time management and lack of proper support from the family are the major factors causing imbalance in work and personal life of women entrepreneurs. Even though the vast majority of the entrepreneurs examined suffered from work life balance issues, there were significant differences in the level of work life balance issues faced by the various categories of women entrepreneurs. The study provided recommendations for human resource professionals, management consultants, academicians and women entrepreneurs themselves to deal with the major work life balance issues faced by Indian women entrepreneurs. Arif & Farooqi (2014) found that work and life balance affects employee's satisfaction and their commitment with the organization. Employer should try to balance employees work and life to get satisfied and committed employees. Understanding the relationship between employee job satisfaction, work life balance and organizational commitment give basis for future research and provide benefits to organization and individual. Choudhary & Shrivastava (2015) stated that emotional intelligence has emerged as a strong factor in managing work life balance, a parameter which needs careful examination by organizations. Flexible work arrangements have also emerged as an important parameter, but it has little or no impact in developing countries as there it is still in its nascent stage. Work life polices of public/private sectors are different. Technology needs to be made a catalyst for managing work life balance and not to misbalance harmony between work and family. Women with dependent children are far more susceptible to work life conflicts; job stress etc. and young people are less susceptible to work life conflicts. Transformational leadership style should be adopted by the organization to balance work and family life. Dixit (2015) found that all individuals have different requirements at different stages in their life and therefore the concept of work life assumes different meaning at each of these junctures.

The review of the above literature indicates that many studies have been undertaken all around the world regarding work life balance, but there is paucity of literature on this subject in India. The present study is therefore an effort to fill this gap of the work already done in this field. The main objectives of the study are:

- i. to identify the level of Work Life Balance among executives in manufacturing sector in Ludhiana and
- ii. to find out present practices followed by executives for work life balance.

**RESEARCH METHODOLOGY**

Descriptive research design was used for meeting the

objectives of study. On the basis of review of literature, the components of work life balance were identified as self, family, technology, leisure, money, change, and time management in the workplace. The study used primary data for analysis purposes and the secondary information was also studied to find the relevant literature and statistics regarding work life balance among executives in manufacturing sector in Ludhiana. For the fulfilment of the objectives, primary data was collected through a pre-tested, structured and non-disguised questionnaire. For fulfilling the objectives of the research, a sample of 5 large scale manufacturing units from private sector was taken on the basis of their willingness to participate in the survey. Also 20 executives were surveyed from each unit on convenience sampling basis making the total of 100. So the primary data was collected from 100 executives from the manufacturing sector of Ludhiana city. Primary data were collected through a pre designed, structured and non- disguised questionnaire. But before designing the questionnaire, a desk research was conducted to study the literature available on the subject. Various studies were reviewed to have a thorough understanding about various parameters to be included in questionnaire and accordingly a self- administered and structured questionnaire was designed to collect information from the respondents. The collection of data was arranged in master table which facilitated tabulation of data in desired form. The desired data were then grouped into the tables and analyzed using descriptive statistics like percentages, mean scores and factor analysis were used. The respondents were asked to give their views with the help of five-point Likert scale.

**RESULTS AND DISCUSSION**

**Components of Work-life Balance**

The mean score of components was calculated to check the level of work-life balance among executives on the basis of gender. Here the 7 components were considered that were used to form the statements. So each component had 2 statements. The average of values of those 2 statements was taken separately for male and female and then total average was also taken. The results thus obtained have been presented in Table 1.

The results presented in Table 1 highlight the level of work life balance on the basis of gender. The results show that out of all the components studied, among males the highest level of work-life balance was found with

**Table 1: Mean level of work life balance**

Component	Male	Female	Total
Self	2.68	2.78	2.73
Time	2.83	2.89	2.86
Technology	2.51	2.68	2.59
Leisure	2.93	2.76	2.85
Money	2.63	2.95	2.79
Change	2.60	2.72	2.66
Family	2.73	2.56	2.64

components technology (2.515), followed by change (2.605) but least balance was found in component of leisure (2.935), however for females the highest work-life balance was found in component of family (2.645) followed by technology (2.68) and least was in money management (2.955). The overall analysis shows that the highest work-life balance was found in the component of technology (2.5975) and least in time management (2.8625). Here the lowest value is considered high work-life balance because the statements are negative. So these findings indicate that respondents are satisfied with the components of level of work life balance.

**The study attempted to assess the dimensions of problems of work life balance using factor analysis technique.** Cronbach's Alpha was computed and its value was found to be .789, ensuring reliability of the used scale. A sample of 100 observations against 14 variables was taken into consideration, thus qualifying the adequate sample size requirement for a stable factor solution. Further, correlation matrix was computed and substantial number of correlations were found greater than 0.40. then, anti- image correlations were calculated and it was observed that these were very low indicating that true factors existed in the data. In the present study the computed value of KMO statistic was .701 ensuring the suitability and appropriateness of the collected value for the application of factor analysis. In our study, Bartlett test's chi- square value was 319.832, which was found to be highly significant indicating adequacy of data for application of factor analysis. By using Principal Component Analysis (PCA) and Latent- root criterion for extraction and retention of factors respectively, only 5 components emerged with the Eigen values greater than 1. Further, the component matrix(without rotation) was constructed. The factor loadings greater than 0.45, were

retained (ignoring signs). The principal factors were orthogonally rotated using Varimax rotation method. There are five factors which accounted for 63.117 percent variance. The percentage of variance explained by the factors 1,2,3, 4 and 5 was 27.087, 11.764, 9.273, 7.686 and 7.306 respectively. All the communalities were above .45 and many of them were above 0.7. It was finally found that the variables  $X_{15}$ ,  $X_3$ ,  $X_5$ ,  $X_9$ ,  $X_{10}$ ,  $X_{12}$  loaded on factor 1, the variables  $X_6$ ,  $X_{11}$ ,  $X_{13}$  were loaded on factor 2, the variables  $X_4$ ,  $X_{14}$  were loaded on factor 3, the variable  $X_7$  was loaded on factor 4 and the variables  $X_2$  and  $X_8$  were loaded on factor 5.

Factors can be labelled symbolically as well as descriptively. Symbolic tags are precise and help avoiding confusion. Present study has also used symbolic tags to factors. The factors along with codes and factor loadings are given in Table 2.

**Factor Labelling**

**Time pressure:** Today is the time when executives don't get enough time for themselves. Their working hours are too long. They are not able to cope up with the latest technology and think that their past learning has become outdated. They are not satisfied with their salary and perks, and feel that their income is not commensurate with their family needs.

**Job insecurity:** Executives feel insecure at their job due to fast changing technology. They are not able to cope up with the changes in work environment. Their family members do not support them in carrying out their responsibilities.

**Social obligations:** Executives often feel that they are short of time or they have torace against the time. They are often worried about education/ marriage/ job of their children.

**Table 2: Factor Analysis w.r.t. problems of work life balance**

Factor	Factor Loadings	Statements included in the factor
Time pressure	0.684	I don't get enough time for myself
	0.572	My working hours are too long.
	0.667	I am not able to cope-up with the latest technology.
	0.505	I am not satisfied with my salary and perks.
	0.438	I feel that my income is not commensurate with my own/ my family needs.
Job insecurity	0.518	I think my past learning is becoming outdated.
	0.719	I feel insecure at my job due to fast changing technology.
	0.508	I am not able to cope up with the changes in work environment.
Social obligations	0.646	My family members do not support me in carrying out my responsibilities.
	0.690	I feel that I am short of time or I have to race against time.
Lack of family Support	0.705	I am often worried about education/marriage/job of my children.
	0.765	I don't get time for outing with my family.
No time for hobbies	0.646	Adequate motivation is not provided by dependents.
	0.774	I don't get time for my hobbies.

**Lack of family support:** Executives don't get enough time for outing with their families. They feel that adequate motivation is not provided by their dependents.

**No time for hobbies:** Executives feel that they don't get enough time for themselves and their hobbies.

In addition the study also performed factor analysis technique on practices related to management of work life balance, where in Cronbach's Alpha was computed and its value was found to be .834, ensuring reliability of the used scale. A sample of 100 observations against 14 variables was taken into consideration, thus qualifying the adequate sample size requirement for a stable factor solution. Further, correlation matrix was computed and substantial number of correlations were found greater than 0.40. Then, anti- image correlations were calculated and it was observed that these were very low indicating that true factors existed in the data. In the present study the computed value of KMO statistic was .839 ensuring the suitability and appropriateness of the collected value for the application of factor analysis. In our study, Bartlett test's chi- square value was 346.569, which was found to be highly significant indicating adequacy of data for application of factor analysis. By using Principal Component Analysis (PCA) and Latent- root criterion for extraction and retention of factors respectively, only 3 components emerged with the Eigen values greater than 1. Further, the component matrix (without rotation) was constructed. The factor loadings greater than 0.45, were retained (ignoring signs). The principal factors were orthogonally rotated using Varimax rotation method. There are three factors which accounted for 51.587 percent variance. The percentage of variance explained by the factors 1, 2 and 3 was 32.259, 10.521 and 8.807 respectively. All the communalities were above .45 and

many of them were above 0.7. it was finally found that the variables  $X_4, X_5, X_6, X_9, X_{11}, X_{12}$  loaded on factor 1, the variables  $X_1, X_3, X_8, X_{10}$  were loaded on factor 2 and the variables  $X_2, X_7, X_{13}$  were loaded on factor 3.

**Factor Loadings**

Factors can be labelled symbolically as well as descriptively. Symbolic tags are precise and help avoiding confusion. Present study has also used symbolic tags to factors. The factors along with codes and factor loadings are given in Table 3.

**Factor Labelling**

**Work management through technology adoption and updating**

**Knowledge:** Executives prioritise their activities and try to manage their time in order to maintain their work life balance. They keep themselves updated with latest technology and use it to speed up their work. They spend money rationally. They keep learning new methods of working and adopting new technology to simplify their household chores.

**Self-management:** Executives take special initiatives to manage their diet. They have made efforts to reduce their commuting time to work. They spend enough time on recreational activities. They invest enough money in saving schemes.

**Focus on managing family responsibilities:** Executives feel they get sufficient time for relaxation/ recreation/ exercise in a day. They organise holidays and picnics with their families. Their spouse/ parents take care of home during their working hours. They spend quality time with their family.

**CONCLUSIONS**

Work Life balance is becoming an increasingly

**Table 3: Factor analytic technique w.r.t. practices related to work life balance**

Factor	Factor Loadings	Statements included in the factor
Work management through technology Adoption and updating knowledge	0.560	I prioritise my activity and try to manage my time.
	0.558	I keep myself updated with latest technology.
	0.563	I use technology to speed up my work.
	0.527	I spend my money rationally.
	0.447	I keep learning new methods of working.
	0.543	I keep adopting new technology to simplify my household chores.
Self-management	0.453	I take special initiatives to manage my diet.
	0.527	I have made efforts to reduce commuting time to work
	0.349	I spend enough time on recreational activities.
Focus on managing family	0.601	I invest enough money in saving schemes.
	0.528	I get sufficient time for relaxation/ recreation/ exercise in a day.
	0.537	I organize holidays and picnics with my family.
	0.470	My spouse/ parents take care of home during my working hours.
	0.558	I spend quality time with my family.

popular concept in recent times. Employees are the force that is behind every successful organisation. No organisation can become successful with technology only because for the use of technology also, organisations need to have strong work force. Every organisation need to give good environment to their workers including all financial and non-financial incentives so that they can retain their employees for the longer period and for the achievement of the organisation goals. Factors identifying the level of work life balance among executives in manufacturing sector were time pressure, job insecurity, social obligations, lack of family support, and no time for hobbies. Practices followed by executives for their work-life balance were work management through adoption and updating knowledge, self-management and focus on managing family responsibilities.

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## **Feminization of Agriculture: A Dream Project**

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### **ABSTRACT**

Agriculture is the largest and oldest private sector enterprise initiated by women over 10,000 years ago. There is evidence to suggest that while men were hunting game in forests, women started gathering seeds and growing them in the backyard of their dwellings. Thus began the era of settled cultivation or agriculture ten to twelve thousand years ago. Agriculture, the single largest production endeavor in India, contributing 25 per cent of GDP, is increasingly becoming a Female Activity. Agriculture sector employs 4/5<sup>th</sup> of all economically active women in the country, 48% of India's self-employed farmers are women. There are 75 million women engaged in dairying as against 15 million men and 20 million in animal husbandry as compared to 1.5 million men. But, still their contribution is not mentioned in GDP calculation also. A major constraint to achieving gender balance in agricultural development is the lack of women among front-line staff. A look at the economic development sector indicates that, official data does not reflect the amount of work that women actually do to enable their families to survive, collecting fuel, fodder or water; keeping poultry, working as unpaid labour on family farms. One-third of agricultural workers are women and many crops depend on extensive labour provided by agricultural labour; yet when it comes to wages, on an average, their wages are 30 per cent lower than men's wages. In this paper an attempt has been made to study the role of women in agriculture and changes in their position at micro level and gender discrimination in land, labour and wage market.

### **Keywords**

Agriculture labour, economic development, farmer, gender balance, gender empowerment

### **JEL Codes**

B54, C82, F63, I31, O13, P46

### **INTRODUCTION**

Agriculture is the largest and oldest private sector enterprise initiated by women over 10,000 years ago. There is evidence to suggest that while men were hunting game in forests, women started gathering seeds and growing them in the backyard of their dwellings. Thus began the era of settled cultivation or agriculture ten to twelve thousand years ago. The woman is the backbone of agricultural workforce and is a vital part of Indian economy. Over the years, there is a gradual realization of the key role of women in agricultural development and their contribution in the field of agriculture, food security, horticulture, dairy, nutrition, sericulture, fisheries, and other allied sectors. Women form the backbone of agriculture, in India, comprising the majority of agricultural labourers, women have been putting in labour not only in terms of physical output but also in terms of

quality and efficiency. The distribution of critical resources like land is also unevenly distributed across gender. Women seldom enjoy property ownership rights directly in their names. Factors which affect supply of labor to agriculture like non-farm employment could also matter to the wage gap. It is well known that the labor flow from agriculture to other sectors has been much more marked for males than for females (Anderson & Eswaran, 2009). Even when women have mutations of land in their names, they may not have actual control over that land. Decision making in cropping patterns, sale, mortgage and the purchase of land or the instruments of production remains in the hands of the men of the household. With unequal access to other resources like credit, skills, and other inputs aggravating this deep inequality, land inequality is one area that is of crucial importance for rural women in India and goes a long way towards

strengthening the unequal socio-economic relations in our society. Observable differences in characteristics and endowments, explain only a small portion of the wage gap. Since the unexplained component is the dominant one, the geographical variation in the wage gap is essentially unexplained.

**Women in Agriculture**

Throughout recorded history, the role of women in agriculture has been multidimensional. Wage differences between males and females are commonly seen in agriculture and in the rural sector (World Bank, 2009). Women have been actively involved in operations relating to crop and animal production, as well as in post-harvest processing and marketing. They have also been instrumental in selecting and storing seeds for sowing in the following season. Many of the activities assigned to women, under the traditional gender division of labour, involve great drudgery and hard work. Rural women form the most important productive work force in the economy of majority of the developing nations including India. Agriculture, the single largest production endeavor in India, contributing 20 per cent of GDP, is increasingly becoming a female activity. The Agriculture sector employs 4/5 of all economically active women in the country. About 48 per cent of India's self-employed farmers are women. There are 75 million women engaged in dairying as against 15 million men and 20 million in animal husbandry as compared to 1.5 million men. Moreover, several farm activities traditionally carried out by men are also being undertaken by women as men are migrated to urban areas. Thus, rural India is witnessing a process, which could be described as feminization of agriculture. While women have always played a key role in agricultural production, their importance both as workers and as managers of farms has been growing, as an increasing number of men move to non-farm jobs. Today 85 per cent of all rural female workers are in agriculture. Women constitute 40 per cent of the agricultural work force and this per centage is rising (Srivastava & Srivastava, 2009). Despite significant contribution of women in the production process, an all pervasive bias of development planners in treating them primarily as consumers of social services rather than producers, kept them away from the development programmes in

agriculture and allied sectors. Boserup (1970) posits that the variation in gender wage differential across states is because of variation in female labor supply. Female labor force participation is much higher in the southern states than in the north. The variation in female labor force participation is in some studies is attributed to varying agro-ecological conditions in India. For instance, wet-rice farming, which traditionally employs female labor, is more prevalent in southern India than in the north (Agarwal, 1986). As men and women have different roles and needs and face gender specific constraints, women may not automatically benefit from development activities, but may remain excluded. So, to create adequate sensitivity among the programme implementers and to facilitate them to perceive and implement agricultural schemes/ programmes with greater gender focus, Government of India, Department of Agriculture and Cooperation (DAC), Ministry of Agriculture (MOA) organized several training programmes.

As seen in the above Table 1 we observe that Males workforce participation from 2001 to 2011 has changed from 51.7 to 53.3 per cent whereas in the case of Females it has changed from 25.6 to 25.5 per cent. The gender gap has increased from 36.1 per cent in 2001 to 27.8 per cent in 2011.

**Table 1: Work participation rate and gender gap India: 2001, 2011**

Sex	(Per cent)				
	2001	Gender gap	2011	Gender gap	Change
Persons	39.1	26.1	39.8	27.8	+ 0.7
Males	51.7		53.3		+ 1.6
Females	25.6		25.5		-0.1

Source: Data computed based on Census Report (2001, 2011)

Census classifies workers into two categories i.e. main and marginal workers. The main workers are those who worked for more than six months in a year and the marginal workers are those who worked for less than six months. The above scenario points out to show a clear cut difference as in main workers there is a gender gap of 30 and 22.7per cent respectively in 2001 and 2011 whereas

**Table 2: Type of workers and gender gap India: 2001, 2011**

Residence	Sex	2001 (Per cent)	Gender gap	2011 (Per cent)	Gender gap	Change
Main	Persons	77.8	30	75.2	22.7	-2.6
	Males	87.3		82.3		-5.0
	Females	57.3		59.6		2.3
Marginal	Persons	22.2	-30	24.8	-22.7	2.6
	Males	12.7		17.7		5.0
	Females	42.7		40.4		-2.3

Source:-Data computed based on census report (2001&2011)

there is negative gender gap in marginal workers with (-30) in 2001 and (-22.7) in 2011.

Table 3 gives a very clear picture regarding the wage rate across whole of India. When whole of the table is analyzed it becomes evident that women are facing wage discrimination across whole of India. When ancomparision of both rural and urban areas is done it is concluded that in urban areas the discrimination among women is more pronounced. The only one positive point in whole table is the state of Bihar. It is the only state where in both rural and urban areas the wages of women labour are more than male workers. In Bihar the women are getting about 8 per cent more wage than men in rural areas but it urban areas the women wage are almost 50 per cent more than the male wages. There are few other states where in either in rural or in urban areas the wages of women are more than men. These states are Haryana, J&K and Punjab.

In rural areas, nearly 84 per cent women workers are engaged in agriculture, either as cultivators or labourers as compared to 67 per cent male workers. Table 4 shows the decline in the proportion of men as well as women in agriculture; but the decline is much sharper for men.

There has been a kind of 'creeping feminisation' of agriculture; male workers have steadily moved out of agriculture (and also out of rural areas) while for women workers, this movement has been extremely tardy. Men

have entered into more diversified occupations in non-agriculture, while women have largely tended to remain in agriculture that has been largely stagnant. In 1972-93, 83.2 per cent male workers and 89.7 per cent female workers were engaged in agriculture. By 2004-05, only 66.5 per cent male workers were in agriculture compared to 83.3 per cent female workers. This has to be seen in the context of the fact that returns to labour are, on average, higher in non-agriculture than in agriculture, although the size of assets operated and type of employment, among other factors, are also relevant.

One implication of the above slow change is that a significant proportion of the incremental female workforce gets engaged in agriculture. Between 1983 and 2004-05, nearly 72 per cent of the incremental rural female workforce was absorbed in agriculture, compared to 40 per cent for the male workforce.

Table 5 analyze the wage structure in different forms of agricultural occupations in India in all the five main forms of agricultural occupation which are taken into consideration it becomes clearly evident that women tends to get less wages than men. Women agricultural casual workers form a distinct category: they are disadvantaged in many ways. As Table 6 shows, there is significant gender segmentation of operations in agriculture. While men predominate in activities such as ploughing and harvesting, women predominate in weeding, transplanting and inter-culture. The wages are uniformly lower in all female dominant operations. Moreover, women also get fewer days of work. Further, women workers rarely get the minimum wages stipulated by the government: more than 95 per cent of female agricultural wage workers received wages lower than the minimum wage (NCEUS, 2007). The deprivation of casual workers is aggravated by the fact that not only are their lower than wages in non-agriculture (about two-third of that level); they have also grown at a lower rate in the recent period, thereby increasing the gap. Moreover, as already pointed out, women workers who work as casual labourers are able to get work for only part of the year – their estimated employment days was only 184 (compared to an already low of 227 for male agricultural labourers). Women agricultural labourers are also unemployed for more days a year than their male counterparts. The unemployment rate for agricultural labourers is quite high in rural areas by any standard; 16per cent for men and 17 per cent for women for 2004-05 by the Current Daily Status criterion and this increased over 1993/94-2004/05 (NCEUS, *ibid.*).

#### OBSERVATIONS OF THE STUDY

In this study one of the most important findings is that though gender disparity and wage discrimination is found across whole India. But when we go to the deeper study we find that rural areas have more discrimination as compared to rural area as compared to urban areas, basically the reason behind this is that the rural areas have low level of literacy, awareness and various social factors

**Table 3: Average wage/ salary earnings per day received by regular wage/ salaried employees, 2009-10**

State	Rural		Urban	
	Males	Females	Males	Females
Andhra Pradesh	198.31	93.84	341.63	248.05
Assam	248.31	95.00	491.19	380.92
Bihar	252.59	271.76	338.31	500.75
Gujarat	187.02	178.08	306.58	221.35
Haryana	299.11	202.04	316.91	330.10
Himachal Pradesh	360.08	224.78	487.56	435.70
Jammu and Kashmir	328.11	335.82	379.61	321.86
Karnataka	195.08	112.60	414.95	293.37
Kerala	290.79	213.29	450.76	320.61
Madhya Pradesh	154.03	138.15	325.15	230.33
Maharashtra	293.76	164.51	439.30	391.71
Orissa	293.87	151.72	358.89	238.48
Punjab	263.87	136.72	342.35	374.49
Rajasthan	261.55	112.99	374.42	317.85
Tamil Naidu	256.49	161.47	319.60	277.23
Uttar Pradesh	235.60	148.11	360.29	285.54
West Bengal	180.21	97.29	391.77	277.08
All India	249.15	155.87	377.16	308.79

Source: NSSO66th Round (July 09 – June 2010) CSO, Ministry of Statistics & Programme Implementation, Government of India, New Delhi and Labour Bureau, RLE Reports on wages and Earnings of Rural Labour Households, 2009-10, Shimla

**Table 4: Percentage of rural male and female workers in agriculture**

Years	1972-73	1977-78	1983	1987-88	1993-94	1999-00	2004-05
Male	83.2	80.7	77.8	74.6	74.1	71.3	66.5
Female	89.7	88.2	87.8	84.8	86.1	85.2	83.2

Source: NSSO (1999-2000) Report on Participation of women in households work and other specified activities and NSSO (2004-05) on Employment-un-employment situation in India. Ministry of Statistics and Programme Implementation, Government of India, New Delhi

**Table 5: All-India annual average daily wage rates in agriculture**

Occupation	Men	Women
Ploughing	102.90	55.43
Sowing	90.00	65.00
Threshing	85.06	67.66
Weeding	80.15	68.02
Picking	81.02	66.37

Source: Labour Bureau, RLE Reports on wages and Earnings of Rural Labour Households, 2009-10, Shimla and Price & Wage in Rural India (New series) NSSO

which have made them a different category of discrimination. When we talk about this wide range of difference between these areas as in urban areas women are coming up in various fields of knowledge as they are getting educated they know their rights and know what they can get for their welfare. Further being illiterate and thus unskilled, they are not able to get skillful jobs and are confined to low skilled jobs, which further increase disparity in rural areas.

#### CONCLUDING REMARKS

The increasing participation levels of women in the paid labour market activities is viewed as a positive outcome for improving women's status by bridging the hiatus in this crucial sphere of economic involvement. However, mere increases in participation remain inadequate in altering the gender inequalities unless these are supported by the nature of work they undertake being decent, lucrative, equally remunerative and secure. If illiterate women are crowding into unskilled, manual labour requiring jobs, that are low paying and hazardous to their health and safety, such a situation can barely be lauded or appreciated. Yet, if more women's labour supplies are being deployed and there exists a demand for their labour, it is of interest to consider the circumstances leading towards this employment. To some extent these may be due to heightening desperation and poverty induced compulsion that women are forced to enter paid labour markets, while at another end of the spectrum these may be outcomes of better educational attainments providing women with the opportunity to undertake jobs hitherto not accessible. The consideration of women's participation in paid spheres of the labour market differs

from that of males due to the stereotypical traditional notion that women's roles are limited to the private, domestic spheres. Since this kind of patriarchal role stereotyping precedes any deliberation on women's contribution to the economy, the space for unbiased consideration and gender based comparison becomes non-existent. A similar constriction or lack of viable options to assess and compare women's efficiency or productivity with that of their male counterparts within employed spheres limits an unbiased assessment of wage inequalities in India. This is further delimited by lack of adequate information to make such wage and income comparisons across equals feasible.

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## Paddy Waste Management: A Research Review

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### ABSTRACT

Huge production of crops like paddy leads to huge amount of waste generation and crop residues thus, enlightening the importance of effective management of paddy waste and by-products. Most common practice to deal with paddy waste and by-products is burning or dumping the waste. In spite of huge usage potential of paddy waste as useful resource, the waste is not managed well. Technical solutions are available, but in most cases a legal framework need to be implemented before a technical solution can be applied. The best solution to deal with the problem is by creating awareness amongst the various stakeholders regarding various issues of paddy waste and straw burning. Also, the implementation of various policies framed by government should be the responsibility of the stakeholders for effective management of paddy waste and by-products.

### Keywords

Crop residues, government support, paddy waste management practices,

### JEL Codes

Q13, Q15

### INTRODUCTION

In Punjab, mainly two cereal crops, wheat and paddy, are grown on rotation during a year. Paddy is the chief crop of Kharif season. Punjab is the largest contributor of rice in the central pool and during 2013–14 contributed about 28 percent of rice to the central pool. Being the largest contributor of main cereals and grains to the central pool, Punjab has earned the title of Granary of India or Food Basket of India (Singh *et al.*, 2015). The production of paddy has increased from 6.50 million tons in 1990–91 to 11.28 million tons in 2013–14 showing an increase of 73.18 percent (Jerath *et al.*, 2014). For rice, top producing districts in Punjab are Sangrur and Ludhiana with production of 1290 and 1137 thousand metric ton units respectively (Anonymous, 2014). This increased production has led to increased quantum of agricultural waste. Agricultural waste is waste which includes both natural i.e. organic and non-natural wastes, produced on a farm as a result of various farming activities. Activities that can be included in farming are dairy farming, market gardens, horticulture, livestock breeding, seed growing, grazing land, nursery plots, and even woodlands (Geoffrey, 2009). Food is lost or wasted throughout the supply chain, from initial agricultural production down to final household consumption (Anonymous, 2016). The

production of food wastes (FWs) is incurred in entire food supply chain, starting from production stage, passing by industrial processing and up to trade, marketing and domestic consumption and handling (Elmekawy *et al.*, 2015). The word agricultural residue is used to describe all the organic materials which are produced as by-products from operations of harvesting and processing of agricultural crops (Zafar, 2013).

### NEED FOR MANAGEMENT OF PADDY WASTE

Huge production leads to huge amount of waste generation and crop residues which amount to as much as 7–8 tons per hectare each year (Gupta *et al.* 2003). Punjab produces around 20 million tons of rice straw annually (Jerath *et al.*, 2014). For every 4 tons of rice grain, about 6 tons of straw is produced. In 2000, the total agricultural residue production in India was 347 million tons of which rice and wheat straw amounted to more than 200 million tons (Thakur, 2002). To manage this huge amount of waste is a serious challenge, thus enlightening the importance of agricultural waste management. Management that puts into practice the principles of four R's i.e., Reduce, Reuse, Recycle and Recover is one of the best first option for effective waste management which includes: reducing the amount of waste generated; reusing the waste product on the farm level or to provide it

toothers for use; and after reducing and reusing the waste product as much as possible, recycle the product either on-farm, for example with and application of manure, or off-farm, such as with plastic recycling programs then Recover a useful product from it for example methane gas from manure waste (Jacobs, 2000). Rice husk is the most abundant agricultural residue in rice producing countries around the world. It is one of the major by-products from the rice milling process and constitutes about 20 percent of paddy by weight (Zafar, 2015). An estimated amount of 650 million tons wheat bran and 354 million tons wheat straw is produced annually in the globe (Bathea *et al.*, 2012 and Knob *et al.*, 2014). Total biomass of wheat bran can be estimated as 150 million tons, which is mainly used in the feed industry for the purpose of cattle feed (Pruckler *et al.*, 2014). 685 million tons of rice straw is generated annually throughout the globe and about 60 percent of the mass produced by rice crop is rice straw (Lim *et al.*, 2012). It is generally removed from the fields at harvest time and is subjected to open field burning which leads to serious environmental and health issues (Sarkar and Aikat, 2012).

#### **PADDY WASTE MANAGEMENT PRACTICES IN PUNJAB**

The open field burning of straw after combine harvesting is a common practice in Punjab in order to ensure early preparation of fields for the next crop. More than 80percent of paddy straw produced in the state is being burnt in fields every year. The wheat straw is used to an extent for cattle feed; whereas paddy straw is not preferred for the purpose of cattle feed due to presence of silica content in it (Jerath *et al.*, 2014). Major factors which compel farmers to burn the crop residue are high cost of collection of agricultural waste and lack of economically viable options to utilize it. Lack of modernized machinery and shortfall of time between paddy harvesting and growing of a new crop is another major problem. Farmers get only 15–20 days between harvesting of paddy and sowing of wheat, therefore a large number of chopping machines are required at low prices so that farmer can opt for chopping straw instead of burning the same (Sandhu, 2015). Burning of straw not only affects soil fertility but also acts as an important source of air pollution in rural areas. It not only leads to the emission of large amounts of suspended particulate matter, but gases like CH<sub>4</sub>, CO, N<sub>2</sub>O, NO<sub>x</sub>, SO<sub>2</sub> and hydrocarbons are also released in air with the burning of straw. Loss of precious nutrients as nearly as 25percent of Nitrogen and Phosphorus, 50percent of Sulphur and 75percent of Potassium is another loss incurred due to burning the of straw. It has been estimated that burning of 1 ton of paddy straw accounts for loss of 5.5 kg Nitrogen, 2.3 kg Phosphorus and 1.2 kg Sulphur, apart from loss of organic carbon. Moreover, heat generated due to burning of paddy straw penetrates into the soil, resulting in loss of moisture and useful microbes, which furthermore adversely affect properties of soil (Jerath *et al* 2014).

#### **SUSTAINABLE MANAGEMENT AND KEY**

#### **DEVELOPMENT DRIVERS FOR WASTE MANAGEMENT**

Wilson *et al* (2013) developed a new analytical framework known as 'integrated and sustainable waste management' (ISWM) for effective, integrated and sustainable waste management. Integrated sustainable waste management consider both the physical components such as collection, disposal and recycling and the governance aspects. Due to rapid industrialization, urbanization and changing waste composition and generation rates, the scenario is more complicated in Asia. The need for integrated waste management is imperative in Asia as waste management technologies are generally conservative in this region (Agamuthu *et al.*, 2007). A major challenge that all the developing nations face with increasing population is management of huge amounts of wastes being generated. With increasing production and development, the waste being generated in enormous in quantum and thus, has made its management unsustainable. So, it is utmost important to generate general public awareness so that the masses become conscious regarding maintaining optimum sanitary measures while treating or disposing the waste (Kalyani & Pandey, 2014). Zaman (2013) studied the key development drivers for waste management which includes social, economic and environmental drivers. The study identified personal behavior, local waste management practice, consumption and generation of waste as the key social drivers. Resource value of waste, economic benefit from waste treatment facilities and landfill tax had been acknowledged as economic drivers for developing waste treatment technology. He further concluded that application and development of municipal solid waste treatment technology depends on various socioeconomic and environmental factors. Agamuthu *et al.* (2007) studied number of drivers in waste management, waste generation and waste composition and further divided those into four broad categories – human, economic, environmental and institutional which he depicted are all intrinsically related to each other. Human drivers include health and well-being, education or awareness etc. Economic drivers are for example, socio economic position of a country, profiting from waste etc and institutional drivers are mainly legislation, Business image and profitability, scientific research etc.

#### **POTENTIAL USAGE OF PADDY WASTE**

Goswami and Rawat (2015) stated that some of the wastes like rice bran, wheat bran, rice straw and wheat straw are an accessible and cheap source of inducers due to presence of the high xylan content. Sabiiti (2011) stated that through use as bio-fertilizer and soil amendment, as animal feed and for production of energy, the agricultural waste can be used to enhance food security. Agricultural wastes contain large amounts of organic matter, and many of them can also be added directly to the soil without any risk. According to Barakah *et al.* (2013) Composting is

another way to transform the waste materials left over from agricultural production and processing into a useful resource. Composting has a potential to turn on-farm waste material into farm resources which makes it an attractive proposition. The author applied Turned windrow method in the composting process. Westerman & Bicudo (2005) stated that production of energy from wastes like animal manures, crop residues, and/or other organic wastes has been utilized in agriculture in different parts of the world to the varying degrees. Several factors that affect utilization of various organic wastes in agriculture are the characteristics of the waste like nutrient and heavy metal content, odor generated by the waste, energy value, benefits to agriculture, availability and transportation costs and regulatory considerations etc. Madurwar *et al.* (2013) explored the potential application of agro-waste as an ingredient for alternate sustainable construction materials. Sustainable construction materials are evaluated based on the availability of agro-waste materials for their physico-mechanical properties, methods of production and environmental impact. Masutti *et al.* (2012) conducted study with the objective to induce the production of lignocellulosic enzymes through the growth of *Pleurotus ostreatus* in solid state fermentation using agro-food wastes like rice husks and wheat straw as substrates. The author concluded that the development of a new solid state bioreactor design for a steady state production of enzymes by using *Pleurotus ostreatus* could open an interesting industrial approach for future. Khan & Mubeen (2012) stated that rice and wheat straw is one of the most abundantly available agricultural by-products. The organic carbon content in wheat straw constituted 34 to 40 percent cellulose, 21 to 26 percent hemicelluloses and 11 to 23 percent lignin content. According to Wang *et al.* (2014) rice straw is one of the cheap and most abundant agricultural wastes that have high potential for use as alternative biomass resource. Rice straw is principally composed of cellulose, hemicellulose and some lignin content. Studies on electricity generation from rice plant in manufacturing companies comprise the usage of rice hydrolysate as a substrate as well as raw rice straw directly in manufacturing companies with cellulose degrading anaerobes. Rice husk, which consists mainly of lingo-cellulose and silica, is not utilized to any significant extent where as it has a great potential as an energy source (Zafar, 2015).

### CONCLUSIONS OF THE STUDY

Paddy waste generation is definitely a challenge for the country and especially for the state like Punjab where production of paddy is in huge quantum. The major challenges in the effective management of paddy waste are low awareness level among the stakeholders of supply chain of paddy waste and byproducts and lack of infrastructure and processing facilities for converting paddy waste to a useful source. Moreover, collection and handling of paddy waste is costly affair due to its

bulkiness. The best solution to deal with the problem is by creating awareness amongst the stakeholders regarding various environmental issues of burning paddy waste and realizing the potential usage of paddy waste and byproducts as energy resource. To permanently address the pollution hazard associated with open field straw burning and to ensure handsome returns to the farmers on their huge stock of paddy straw, a policy for utilization and management of paddy straw is being formulated by State government but the implementation of various policies framed by government should be the responsibility of the stakeholders of whole supply chain. Ensuring its optimum use for power generation as a renewable source of non-conventional energy is crucial step for effective utilization of agricultural waste.

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## An Economic Evaluation of Aonla Candy Processing Unit

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### ABSTRACT

Aonla is one of the oldest Indian fruits and considered as "Wonder fruit for health" because of its highest nutritive with a great medicinal use. The processed product viz; Aonla candy was selected for study as it is produced and marketed on large scale at jurisdiction of University. The quantity of Aonla used for processing was 2591 kg. The investment on building was the major cost of fixed capital (20.70 per cent). The Total variable cost was ₹112136.50. The per Kg cost of Aonla candy processing was estimated to ₹116.90. Aonla candy was profitable with a net profit of ₹63763.50. The benefit-cost ratio was 1.54 in Aonla candy processing. The added gross returns and net returns were ₹130070 and ₹63763.50, respectively. The ICBR ratio was 1.96. Aonla candy processed was much higher than that the quantity required for break-even. It is therefore inferred that, the performance of processing the Aonla candy was satisfactory and it is a profitable processing unit. The benefit cost ratio in Aonla candy processing was 1.54 at counter sell indicated that each rupee invested fetched higher returns from these processed products. It is therefore recommended to commercialize the processing of value added product viz; aonla candy and make it popular in domestic and urban market at University level or through Public Private Partnership (PPP) mode.

### Keywords

Aonla candy, processing, production and marketing, value addition

### JEL Codes

L20, L22, M30, M311, M39

### INTRODUCTION

Aonla is an important fruit crop indigenous to Indian sub-continent, which can be grown successfully in dry and neglected regions. The area under aonla has been expanding rapidly in the last couple of years. Aonla is one of the oldest Indian fruits and considered as *Wonder fruit for health* because of its unique qualities. Aonla fruit is highest nutritive with a great medicinal use and the richest source of Vitamin C.

The fruit is used as an anti scorbic, diuretic and laxative (Singh and Pathak, 1987), hence used for treating common cold, gastric troubles, acidity and scurvy (Tandon *et al.*, 2005), dysentery and bronchitis, diabetes, diarrhoea, jaundice and dyspepsia (Bhosale *et al.*, 2000) and coughs, asthma, headache, ophthalmic disorders, colic, flatulence, skin diseases, leprosy, and greyness of hair etc. This fruit is extensively used in the preparation of Ayurvedic and Unani medicines like Chyavanprash, which promotes health and longevity (Rajkumar *et al.*, 2001). It contains 500-1500 mg of ascorbic acid per 100g of pulp. The gallic acid present in Aonla fruit has

antioxidant properties. The fruit is a very good source of Vitamin C containing chemical substances called lucoenthocyanin and polyphenols which retard the oxidation of Vitamin C. The main objective of the study is to highlight its uses, existing processing methods and their limitations and further propose to develop pilot plant for aonla processing.

Fruit candies are becoming more and more popular because of high acceptability, minimum volume, higher nutritionally value and longer storage life. These have additional advantage of being least thirst provoking and ready to eat snacks. The processed products Aonla candy is rich in vitamins, minerals and nutrients.

The processing of aonla is therefore important. The economics involved in the processing of these fruits to be worked out for testing feasibility. The study is thus, is of paramount importance. In view of this the present study was outlined with the following specific objectives.

### OBJECTIVES

- To estimate the production cost of aonla candy
- To examine the profitability of aonla candy

- c. To study the marketing cost of aonla candy
- d. To study the problems in processing and marketing of aonla candy.

**METHODOLOGY**

Post-Harvest Technology Unit (PHT) was established in the year 1998 at Central Campus, MPKV, Rahuri. PHT unit is preparing different value added products viz; Mango pulp, mango drink, Jamun juice, jamun powder, Aonla candy, aonla drink aonla supari etc. The processed products aonla candy was selected for study as it is produced and marketed on large scale at jurisdiction of University. The installed capacity of aonla candy is 500 kg/day.

The data on fixed inputs, variable inputs, total quantity processed, total sale etc were collected from PHT unit for the year 2014-15. Data were analyzed by using simple arithmetical and statistical tools such as percentages, averages, ratios etc. The Break-even analysis was also estimated by following formulas.

$$Q = \frac{TFC}{[Pc - AVC]}$$

Where,

Q= Quantity of processed product required for break even

TFC= Total fixed cost (₹)

Pc= Sale price of processed Product (per kg)

AVC= Average variable cost (per kg)

**RESULT AND DISCUSSION**

The fresh aonla fruits are not popular as a table fruit due to their high astringency and its storability after harvesting is also limited due to its high perishable nature (Kumar & Nath, 1993). It has got great potential in processed forms, which can have great demand in national as well as international market. Hence attention has been focused on the preparation of value added product viz; aonla candy.

**Quantity Processed by PHT unit**

Quantity of value added product used for processing is given in Table 1. It was revealed from the Table 1 that, the quantity of aonla used for processing was 2591 kg. The purchase rate for aonla was ₹20 per kg. The total cost on account of raw material (aonla) was ₹51820. The quantity of value added product (Processed product) aonla candy was 1010.50 kg with the recovery of 39.00 per cent.

**Table 1: Quantity of value added product Aonla candy**

Items	Aonla candy
Raw material processed (kg)	2591
Purchase rate (₹/kg)	20
Raw material price (₹)	51820
<b>Total quantity produced</b>	<b>1010.5</b>
Recovery (per cent)	39.00

**Fixed and variable cost**

Investment on fixed and variable inputs is given in Table 2 and 3. The results revealed that the investment on building was the major cost of fixed capital (20.70 per cent) and followed by depreciation (14.19 per cent) and land rent (10.85 per cent) respectively for processing of the value added product viz; aonla candy. The total fixed capital investment for processing of aonla candy was ₹5990.

**Table 2: Fixed capital investment for processing of aonla candy**

Items	Investment (₹)
Land rent	650 (10.85)
Building	1240 (20.70)
Depreciation(Furniture & Equipment)	850 (14.19)
Interest on Fixed Capital	3250 (54.26)
<b>Total</b>	<b>5990 (100.00)</b>

Figures in brackets are percentages to the total

**Table 3: Variable inputs used for processing of aonla candy**

Items	Variable cost	Per cent
Raw material price	51820	46.21
Fuel cost	1000	0.89
Labour	10000	8.92
Packing cost (₹0.50/polythene pack)	<b>1818.90</b>	<b>1.62</b>
Additives, preservatives, colour etc.		
Citric acid	25	0.02
Sugar	40925.25	36.50
Others expenses (Light bill, stationery)	200	0.18
Working capital	105789.1	94.34
Interest on working capital @ 6 per cent	6347.35	5.66
<b>Total variable cost</b>	<b>112136.5</b>	<b>100.0</b>

**Variable Cost for Processing of aonla candy**

In aonla candy processing, raw material cost was the major item of cost (46.21 per cent) followed by expenditure on sugar (36.50 per cent). The total packing cost was ₹1818 whereas the total variable cost was ₹112136.50 (Table 3).

**Processing cost**

The detailed processing cost is presented in Table 4. It is revealed from the Table 4 that, variable cost has the major share in total cost. The per kg cost of Aonla candy processing was estimated to ₹116.90/kg.

Yadav *et al.*(2015) and Kenghe (2016) also studied the

**Table 4: Processing cost of value added products aonla candy**

Items	Investment	Per cent
Fixed cost	5990	5.08
Variable cost	112136.50	94.93
Total cost (FC+ VC)	118126.50	100.00
Per kg cost	116.90	

cost of preparation of whole pricked aonla candy. They worked out the cost of processing of aonla candy and it was ₹82.50/kg and ₹91.20/kg respectively.

#### Cost and Returns

Cost and returns, value addition and profitability for value added product i.e. aonla candy is presented in Table 5 and 6.

**Table 5: Costs and returns of value added products aonla candy**

Particulars	Cost and returns
Total returns	181890
Total cost	118126.50
Net returns	63763.50
B: C Ratio	1.54

**Table 6: Value addition and profitability from aonla candy**

Particulars	Value (₹)
Gross return	181890
Cost of fruits (Raw material)	51820
Cost of fruit processing	66306.50
<b>Total cost</b>	<b>118126.50</b>
Net returns	63763.50
<b>Added value</b>	
Gross return	130070
Net returns	63763.50
Gross return/kg	128.72
Net returns/kg	63.10
Added cost	66306.50
Added returns	130070
Added cost/kg	65.62
Added returns/kg	128.72
<b>ICBR Ratio</b>	<b>1.96</b>

From the Table 5 it was revealed that benefit cost ratio of aonla candy was 1.54 which indicates that there is an opportunity to choose products for processing from economic point of view. aonla candy was profitable with a net profit of ₹63763.50. Yadav et al. (2015) also worked out the benefit cost ratio of aonla Candy which was estimated to be 1.80.

The perusal of Table 6 indicates that for aonla candy processing, the fruit processing cost was ₹66306.50. While the total cost incurred for aonla candy was worked out to ₹118126.50. The added gross returns and net returns were ₹130070, and ₹63763.50 respectively. The ICBR ratio was 1.96. The gross return was ₹128.72/kg. While Yadav et al. (2015) also observed gross return ₹148.50/kg.

#### Break-even Analysis

The term break-even point is used to describe the percentage of capacity operation of manufacturing plant at which income will just cover the expenses. The estimated break-even quantities of aonla candy required to be processed is presented in Table 7.

It is evident from the Table 7 that, the actual quantities of Aonla candy processed for break-even were much higher than that the quantity of these values added products required for break-even. It is therefore inferred that, the performance of processing the aonla candy was satisfactory and it is a profitable processing unit.

**Table 7: Break-even point analysis**

Particulars	Aonla candy
Fixed cost (₹)	5990
Sale price per kg of processed products (₹ per kg)	180
Variable cost per kg of processed products (₹)	110.97
Actual quantities processed (kg)	1010.5
Quantities required to be produced for the break-even (kg)	86.78

#### Problems of Processing and Marketing

The major problems regarding processing, storage and marketing were shortage of skilled manpower, shortage of raw material due to seasonal availability of fruits, wastage of raw material, underutilization of installed capacity, weak marketing chain, etc.

#### CONCLUSIONS

1. The average quantity of processed products (aonla candy) prepared by PHT unit was 1010.5 kg.
2. The 2591 kg aonla (raw material) was utilized for producing 1010.50 kg of aonla candy with recovery of 39.00 per cent.
3. The cost of processing for aonla candy was ₹116.90/kg.
4. The benefit cost ratio obtained in aonla candy was 1.54. It indicates that the performance of aonla candy was more satisfactory and it is a profitable venture.
5. Added value at net returns was more (₹63763.50) in aonla candy processing.
6. The ICBR ratio was 1.96 hence, the aonla candy was profitable venture.
7. It is necessary to sell the processed products at different locations for commercialization purpose.

- Consumer awareness to be increased through advertizing, attractive packing, selling at cosmopolitan cities, or at pilgrim centers.

#### **POLICY IMPLICATION**

The benefit cost ratio in aonla candy processing was 1.54 at counter sell indicated that each rupee invested fetched higher returns from this processed products. It is recommended to commercialize the processing of aonla candya values added product and make it popular in domestic and urban market at University level or through Public Private Partnership (PPP) mode.

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## **Economic Analysis of Ready to Eat Snack Food-Spicy Paneer**

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### **ABSTRACT**

*Spicy paneer was prepared by addition of oleoresins of ginger, green chilli, cumin and black pepper. Spice oleoresins are the concentrated liquid form of the spice and reproduce the character of the respective spice and spice oil fully. Spicy paneer using oleoresins is the new ready to eat snack food. Oleoresins are economical, with easier quality control, require lesser storage space, longer shelf life, no bacterial contamination and are a convenient substitute for ground spices with a standardized taste and aroma. Total cost of production of spicy paneer was worked out to be ₹213 per kg. Considering the prevailing market price of spicy paneer was ₹250 per kg, a profit of ₹37 per kg could be obtained which is a good profit margin for the commercial viability and sustainability of the product. The break even output was calculated at 8.94 kg of product which is much lower than the actual level of production providing enough margin of safety.*

### **Keywords**

Breakeven point, fixed cost, spicy paneer, variable cost

### **JEL Codes**

Q12, Q13

### **INTRODUCTION**

India contributes about 18 per cent of the world milk production and it is expected to increase up to 30-35 per cent in 2020. The Food and Agriculture Organization (FAO) has reported a 3.1 per cent increase in world milk production from 765 million tonnes in 2013 to 789 million tonnes in 2014 (Anonymous, 2016). India contributes to about 35 per cent of total Asian milk production. (Anonymous, 2015a). India ranks first in milk production, achieved an annual output of 146.3 million tonnes during 2014-15 as compared to 137.69 million tonnes during 2013-14. The per capita availability of milk is around 307 g per day in 2013-14 in India, has increased to 322 g per day by 2014-15. As per 2011 census, India's population stands at 1.21 billion and it is estimated that by 2030 it may be 1.6 billion, contributing to more than 17.5 per cent of the global population. Indian dairy production is growing at a rate of about 4 per cent per year, while consumer demand is growing at approximately double that rate. In response to strong demand for milk products, it is mandatory for the Indian dairy industry for raising the production in several ways. With the expected milk production and population,

the dairy sector needs to grow at least six percent per annum to meet the milk demand.

In India, about 50 per cent of the milk produced is consumed in the liquid form and the remaining is used to prepare products such as ghee, curd, butter, khoa, paneer, cheese, chhana, ice cream and milk powders. The demand for these products is increasing every year. There is a great concern to produce high quality with long life products that requires hygienic modern processing and preservation technologies. The organized dairies in India have to modernize and scale-up the production in order to meet the demand.

Paneer can be defined as "the product obtained from cow or buffalo milk or a combination thereof by precipitation with sour milk, lactic acid or citric acid. It shall not contain more than 70 per cent moisture and milk fat shall not be less than 50 per cent on the dry matter. The milk fat of skim milk paneer shall not exceed 13.0 per cent of the dry matter" (FSSR, 2011). Milk solids may also be used in preparation of this product. In India, around 7 per cent of the total milk produced is being converted to paneer. Paneer is consumed throughout India, especially,

North India accounts for the largest share in demand at 55–60 per cent. The demand for the western and southern regions is only 15–20 per cent. In Paneer marketing, unbranded market accounted for over 95 per cent, rest only with branded market. In addition expected that the branded market will grow by 20–25 per cent annually in value terms, as players increase retail penetration (Anonymous, 2015b). The key factors such as good taste, quality and a long shelf life that could ensure success for a branded player in the retail segment. Paneer has been a delicacy from ancient times which can be used in the preparation of a variety of culinary dishes and snacks. The bland taste of paneer is the main drawback for consumer acceptability; this problem can be eliminated by introducing spicy paneer. Oleoresins can be defined as the pure extracts of the spices/herb and can replace whole/ground spices without impairing any flavor and aroma characteristic. Spice oleoresins are mainly used in processed meat, dairy, fish products, vegetables, soups, sauces, chutneys, dressings, baked foods, confectionery, snacks and beverages.

Livestock farming especially dairying have shown higher profits and acceptability over years and emerged as viable alternatives to crop agriculture in Punjab. Intensive cultivation of wheat-paddy crops over years coupled with high use of fertilizer and chemicals have deteriorated soil health and lowered water table, polluted environment, thus affecting animal and human health. Diversification to livestock is the best alternative to rice-wheat cycle for higher profitability and maintaining water table and soil health in the state. Dairying provides good employment and income to the farmers but small dairy farms have poor viability due to rising feed costs and low milk yield levels. At these farms, value addition of milk is a good option for generating employment and enhancing the income levels. For resource poor small and marginal farmers who cannot invest more in the initial stage in value addition of milk, manufacturing products like spicy paneer can be started with low initial investment. The present study has been undertaken in this direction with an objective to determine the cost and returns associated with manufacturing of spicy paneer.

#### METHODOLOGY

The spicy paneer was prepared in the laboratory using method described by Bhattacharya *et al.* (1971) with slight modification. The cost of various components used in the manufacture of spicy paneer was taken into consideration. For the cost estimation of final product, certain set of assumptions were made. The manufacturing cost of spicy paneer was calculated as per the guidelines suggested by Chauhan *et al.* (2006) and Chauhan *et al.* (2009)

#### Location

It is assumed that the spicy paneer manufacturing unit was set up at his own land of the entrepreneur in semi-urban area to make sure that there is easy supply of raw material especially milk. The figure for land rent was

taken at the rate of prevailing market rate of the area.

#### Land and building

The total working space required for spicy paneer unit was assumed to be 400 feet<sup>2</sup> (20×20 feet<sup>2</sup>) and it was taken on rent (@ ₹6000/-per month). Building includes processing section, store and utilities section.

#### Machinery and Equipment

Capital investment (₹4,00,000) includes the cost of all equipments viz. paneer vat and its accessories and refrigerator. Depreciation on machinery and equipments was taken @10 percent per annum. Interest on capital investment and variable cost was taken @12 percent per annum.

#### Manpower

One skilled and one unskilled person were required for manufacturing spicy paneer. The working days for the year were assumed to be 300 days. It was assumed that wages of evolved manpower would be as follow: Labour @ ₹ 277.72 per day for unskilled and ₹ 342.22 per day for skilled.

#### Capacity

One batch of spicy paneer was made from total of 100 kg raw materials and yield of the final product was 18 per cent (18 kg) of the raw material. One batch requires four hours time. Hence, for properly utilizing the labour and other resources, two batches can be made in a day.

#### Break-Even Output

The break even output is the minimum number of units of finished product produced at which the total revenue equals total cost. A firm will continue its production process or will remain solvent as long as the total revenue is greater than or equal to the total cost. Break even output provides us with an estimate of the output produced at that level.

Break Even point= Total Fixed Cost/ (Sales price per unit– Variable cost per unit)

Margin of safety =  $\frac{\text{Actual production} - \text{Break even output}}{\text{Actual production}} \times 100$

#### Marketing and distribution

It was assumed that all finished product was directly sold to the consumers as per demand from the factory itself. So, the calculated cost of production as well as profit per batch is ex-factory before taxes. It does not include any marketing and distribution charges.

#### RESULTS AND DISCUSSION

Conventional spicy paneer is a popular traditional product available in market. However; there is a huge variation in the product quality and price variation from one shop to another across the market. Considering the lack of uniformity in the market samples of the spicy paneer, the present investigation was carried out to develop the spicy paneer with incorporation of oleoresins to get uniformity in the product. Cost of production is one of the most important factors for the commercial viability of any enterprise.

The cost of each ingredient prevailing in the market is

taken into consideration while calculating the cost of production. Therefore, through present investigation, an attempt has been made to estimate the cost of production of standardized spicy paneer with incorporation of oleoresins by taking into consideration of certain set of assumptions. The cost of spicy paneer and profitability were estimated and detailed categorization of different cost components into per unit fixed, variable and total cost are presented and summarized in succeeding sections.

Capital investment (₹4,00,000) includes the cost of all equipments viz. paneer vat & its accessories and refrigerator. The costing methodology will breakup and categorize the overall cost of manufacturing the spicy paneer into its different components that is, fixed costs and the variable costs.

#### Fixed cost

The annual fixed cost of spicy paneer unit comprises of depreciation on equipments, interest on capital investment and building rent which has been presented in Table 1. A perusal of the table revealed that total fixed cost per annum was found to be (₹1,60,000) out of which major share was on building rent (₹72,000) followed by on interest on capital investment(₹8,000)and on depreciation on equipments (₹40,000). The fixed cost per

**Table 1: Fixed cost of spicy paneer unit**

Particulars	Cost (₹)
<b>Total Capital investment required</b>	<b>4,00,000</b>
<b>Fixed cost</b>	
Depreciation on Equipments @10 per cent p.a.	40,000
Interest on Capital Investment@12 per cent p.a.	48,000
Building rent per annum	72,000
Fixed cost per annum	1,60,000
<b>Total fixed cost per day (batch 100 kg) (A)</b>	<b>Rs. 438</b>

**Table 2: Variable cost of spicy paneer unit**

Variable cost	Quantity required per batch	Cost (₹)
Raw materials		
a. Ginger oleoresin (2267/kg)	7ml	15.86
b. Green chilli oleoresin (6170/kg)	3ml	18.5
c. Cumin oleoresin (1255/kg)	8ml	10.04
d. Black pepper oleoresin (4598/kg)	5ml	22.98
e. Mixed milk for paneer making(30/kg)	100 kg	3000
f. Salt(22/kg)	300g	6.6
<b>Total raw material cost/ Batch</b>		<b>3073.98</b>
<b>Total raw materials cost for 2 batches</b>		<b>6147.96</b>
Labour @ ₹277.72/Day for unskilled and 342.22/Day for skilled	Unskilled= 01; Skilled = 01	619.94
Packaging material@ ₹1/pouch	180	180
Electricity @ ₹8/unit	35	280
Laboratory charges@ 0.2per cent of raw materials		12.28
Cleaning and sanitizing materials@ 0.1per cent of raw materials		6.14
Total		7246.32
<b>Total variable cost per day (for two batch)</b>		<b>7246.32</b>
<b>Total cost per day for two batches</b>		<b>7684.32</b>

day was observed to be ₹438 per day.

#### Variable Cost

Various components of variable cost have been presented in Table 2 and it constitutes about 94 per cent of the total cost of spicy paneer production. It is evident from table 2 that the largest share among the variable cost is of raw materials, ₹6147.96 (84.84 percent) followed by labour cost (₹619.84) constituting 8.55 percent and electricity charges with ₹280 (3.86 percent) while other cost components like packaging material, laboratory, cleaning and sanitizing together accounted for about 2.75 percent only. Total variable cost was found to be ₹7246.32. Total cost of production of spicy paneer was worked out to be ₹7684.32 per day for two batches which includes fixed cost of ₹438 as well.

#### Returns from spicy paneer

Considering the prevailing market price of spicy paneer is ₹250.00 per kg, a profit of ₹37.00 per kg could be obtained which is a good profit margin for the commercial viability and sustainability of the product. The profit margins were more in case of spicy paneer as its selling price is higher than conventional spicy mainly because of being a new functional food and have a more demand in market due to favorable consumer preferences. The yield per 2 batch of spicy paneer is 36 kg. The total cost of spicy paneer is ₹213 per kg. Gross returns per day were found to be ₹9000 and net returns after deducting all costs were found to be ₹1316 per day. On monthly basis, an entrepreneur can earn as much as ₹39480 per day.

The break even output is the minimum number of units of finished product produced at which the total revenue equals total cost. The Break Even output was calculated at 8.94 kg of product which is much lower than the actual level of production (36 kg) providing enough margin of safety (75.16 per cent).

**Table 3: Returns from spicy paneer manufacturing /day**

Particulars	₹
Yield per 2 batch	36 kg
Total cost per kg	213/-
Sale price per kg	250/-
Gross returns	9000
Net returns	1316
Net returns per month	39480
Profit per kg	37/-
Total fixed cost	Rs. 438
Variable cost per unit	Rs. 201
Break even point	8.94 kg
Margin of safety	$(36-8.94)/36*100 = 75.17$ per cent

### CONCLUSIONS

It is evident from foregoing discussion that a small spicy paneer production unit is a profitable enterprise for the farmers can earn a monthly income of about ₹40000. Its adoption can help in providing regular income and employment to the farmers, especially small and marginal ones. In the period of much needed diversification of Punjab agriculture, such small scale dairy processing enterprises can be good option for ameliorating the economic distress in farming sector. As bigger dairy

plants require large capital investment in initial stage, so starting a spicy paneer production unit is a good option for small and marginal farmers who can easily start this business with low initial investment.

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## **A Study on Jaggery Production Export Status and Doubling Farmer Income in Potential District of Maharashtra**

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### **ABSTRACT**

*Sugarcane is the main raw material required in the preparation of sugar and jaggery. India is the largest producer of the sugar and jaggery in the world. Since ancient times, jaggery has been an important item of food and even today. Trend analysis shows sugarcane production was increases but in the year 2007-08 slight variation, further results have shown that the price of jaggery is directly related with the production of sugarcane in the study area. At the same time by using the power function it is expected the jaggery price for the year 2015-16 and 2016-17 will be ₹2895.375 per quintal and ₹2972.589 quintal respectively. There are some quality factors which determine the price of the jaggery from both wholesaler and trader point of view and from wholesalers' point of view it was observed that, color, packaging and uniformity were major factors to determine jaggery prices while as oer exporters' point of view season, color and packaging were major factors to determine jaggery prices. Further the major problems faced by the different stakeholders i.e. jaggery producers, traders and exporters were also studied. It was observed that most severe problem faced by jaggery producers and traders was high fluctuation in prices, followed by high commission charges, malpractices during transportation and delay in payment. From exporter point of view, most severe problem was price fluctuation in international market, followed by lack of quality products, and fluctuation in international demand. The study revealed that with addressing these issues growers can be benefitted and further an attempt can be made towards doubling their income.*

### **Keywords**

Export, jaggery cottage industry, jaggery production, price forecasting

### **JEL Codes**

C29, C32, C81, C83, C88, O13, Q19

### **INTRODUCTION**

Indian agriculture has undergone spectacular technological changes during the last three decades resulting in increasing agriculture output and productivity. However, the major concern is that this has been unable to ensure a stable income to farmers. The benefits of new production technology will not sustain for a longer period unless simultaneous efforts are made in improving the marketing system as a whole. The basic function of marketing is not only to bring about synchronization between the Indian agriculture has undergone spectacular technological changes during the last three decades, resulting in increasing agriculture output and productivity (Dwivedi, 2010). However, the major concern is that this has been unable to ensure a stable income to farmers. The benefits of new production technology will not sustain for a longer period unless simultaneous efforts are made in improving the marketing system as a whole (Noronha & Thakor, 2012).

The basic function of marketing is not only to bring about synchronization between the demand and supply of agriculture

commodity, but also to ensure remunerative and affordable prices for producers and the consumers respectively (Naidu & Reddy, 1981). Marketing of agriculture commodities has assumed a greater importance with gradual switching over from subsistence farming to commercial farming.

Stable farm prices, better returns and attractive terms of trade can motivate farmers to produce more and market larger proportion of their produce. A steep rise in production cost and wide fluctuation in the prices of agricultural commodities are two major factors affecting the income levels of farmers (Pagar, 2011). The price elasticity of demand and supply of agricultural commodities being fairly low and demand for these commodities rising steadily, their price instability is largely attributed to the changes in their production and the consequent changes in the market arrivals (Wadke, 2014). The price instability is more pronounced in the case of commercial crops like groundnut, sunflower, chilli and sugarcane. The minimization of fluctuation in the prices of commodities over space and time through adequate processing, transportation,

storage and other facilities not only stabilize the income of the farming community but also synchronizes the demand and supply of farm products (Ravindra *et al.*, 2004). The scope for stabilization of income of the farming community is more in those crops where the produce cannot be held back from the farmers for a long period without proper processing and storage facilities. Sugarcane is one such crop (Shivaramu *et al.*, 2002). Sugarcane is grown extensively in India. The crop occupies over 41.46 lakh hectares in the country with a production of ₹2811.7 lakh tonnes, of which 66 percentages are concentrated in the northern part of the country.

#### Jaggery Cottage Industry

The jaggery industry has been considered as one of the small scale and cottage industry in India. From time immemorial, sugarcane crop has been known as a cash crop by Indian cultivators and so also the preparation of jaggery. The production of jaggery ranges between five million tones to seven million tonnes. It is estimated that two third of the sweetening requirement in rural areas is met by jaggery. The jaggery industry in the country has thus, been continued to be an industry of great importance and relevance. Jaggery industry has undergone several changes over the years. Kolhus used for crushing sugarcane have been replaced by power crushers in many parts of the country. This has helped improve the efficiency of the industry by the way of enhanced extraction percent of the juice from the cane.

The process of preparation of jaggery has also undergone considerable changes. As a result of these changes the jaggery industry is offering a stiff competition to the sugar industry for sugarcane. The sugar industry claims that the discriminatory policies of the government have helped divert large portions of sugarcane towards jaggery industry, especially at times of sugar shortage. The sugar committee of the Imperial Council of Agricultural Research recommended in a study on existing conditions of jaggery with a view to improve the jaggery preparation process in the year 1937. To cover all the aspects of present study following objectives were analyzed through this study.

- i. Trend analysis for sugarcane production and export status of Kolhapur jaggery.
- ii. Analysis the product quality factors determining jaggery prices.
- iii. Identification of major constraints faced by jaggery producers, wholesalers and exporters

#### MATERIALS AND METHODS

The study was conducted in Kolhapur district of Maharashtra to assess the extent of marketing knowledge of respondents and to identify the problems faced jaggery producer in the study area.

##### Collection of Data

**Sources of data:** Both primary and secondary data were collected for the study.

**Primary data:** Primary data were collected through pre-structured schedule by personal interview with jaggery producer and those who are switching jaggery producers.

**Secondary data:** Secondary data were collected from the Directorate of Agriculture, Government publications, APMC of Kolhapur, "Shri Chhatrapati Shahu Sahkari Gul Kharedi Vikri Sangh" report, Internet, Journals, and Magazines etc.

Different techniques were used for different objectives

1. Calculating price forecasting by using trend analysis
2. Garrett's Ranking Technique used to assess the factors determining jaggery prices

3. Rank Based Quotient (RBQ) Technique used for Identification of the major constraints faced by jaggery producers, wholesalers and exporters.

#### Sampling

##### Judgement criteria

A producer who has experience of jaggery production was selected.

A producer who has switch there jaggery production plant.

Potential wholesalers and exporters was selected for as per their market status.

##### Objective 1: Trend analysis for sugarcane production and export status of Kolhapur Jaggery

The objective has aimed to study the total sugar cane production in the study area and how much raw sugar cane converted for jaggery production also there trend and pattern of arrivals and prices of jaggery in Kolhapur APMC. According to collecting data Trend Analysis was being done to study the trend of crop in the study area that was depicts future prospect of jaggery prices and finding export status.

##### Objective 2: Analysis the product quality factors determining jaggery prices

In order to identify and quantify the critical factors affecting the jaggery prices the Garrett ranking technique was adopted. Based on the Garrett values, the ranking will be done to nine specific quality factors viz., colour, taste, structure, texture, flavor, uniformity, size, packaging and season of jaggery production which were considered while fixing the price of jaggery. The quantification of data was done by first ranking the factors based on the responses obtained from the respondents and the Garrett value was calculated.

##### Objective 3: Identification of the major constraints faced by jaggery producers wholesalers and exporters

It has aimed to identify the various problems of jaggery producer, wholesalers and exporters. An ordinal scale will be used to collect response from jaggery producers and Rank Based Quotient technique was applied to rank variables. This was showing the rank according to its prevalence and extent of a rank.

The following formula was used in the calculation.

$$RBQ = \frac{\sum [fi(n+1) - i]}{Nxn} \times 100$$

RBQ = x 100

Where,

RBQ = Rank based quotient

fi = No. of respondents reporting a particular factor under it rank

N = Total number of respondents

n = Number of factors

#### Finding and Analysis

##### Trend Analysis for sugarcane production and Export Status of Kolhapur Jaggery

The perusal of Table 1 shows that the area under sugar cane production is increasing over year except 2010-11 in Kolhapur district of Maharashtra. The production decreased in the same year due to the reduction of sugarcane area in that year. But the yield is showing an irregular trend over the years. The price of jaggery is directly related with the production of sugarcane in the study area. It is evident from the graph that in the year 2007-08 the price of jaggery is at lowest when there was a low production of sugarcane in that year.

The graph shows the price movement of the jaggery over ten years in Kolhapur district. There was consistent increase in the prices but a steep fall is occurred during 2007-08 because of

**Table 1: Sugar cane production in Kolhapur**

Year	Area (ha)	Production (tonnes)	Yield (t/ha)
2007-08	4012	330588.80	82.40
2008-09	76300	6529754.00	85.58
2009-10	104500	7994250.00	76.50
2010-11	81390	6962100.60	85.54
2011-12	102500	8461300.00	82.55
2012-13	112700	9810000.00	87.05
2013-14	139900	12591000.00	90.00

low production of sugar cane in the area. By using the power function it is expected the jaggery price for the year 2015-16 and 2016-17 will be ₹2895.375 per quintal and ₹2972.589 quintal respectively. However, the price will be near to ₹3000 per quintal in coming years. The R<sup>2</sup> value is 0.6761, shows that the explanatory power of the variable under consideration is sufficient to describe the function.

**Analysis the Product Quality Factors Determining Jaggery Prices**

The per capita consumption of sucrose in India is much lower (15 kg), compared to that of developed countries (50 kg). Major share (above 75 percent) of sucrose consumption in rich Countries have been through manufactured foods. But, excessive sucrose consumption leads to a variety of problems such as dental curies and coronary thrombosis. To over-come these problems many of these countries are seriously looking for alternative sweeteners from sugarcane crop. India has one of such eco-friendly sweetener jaggery which contributes more

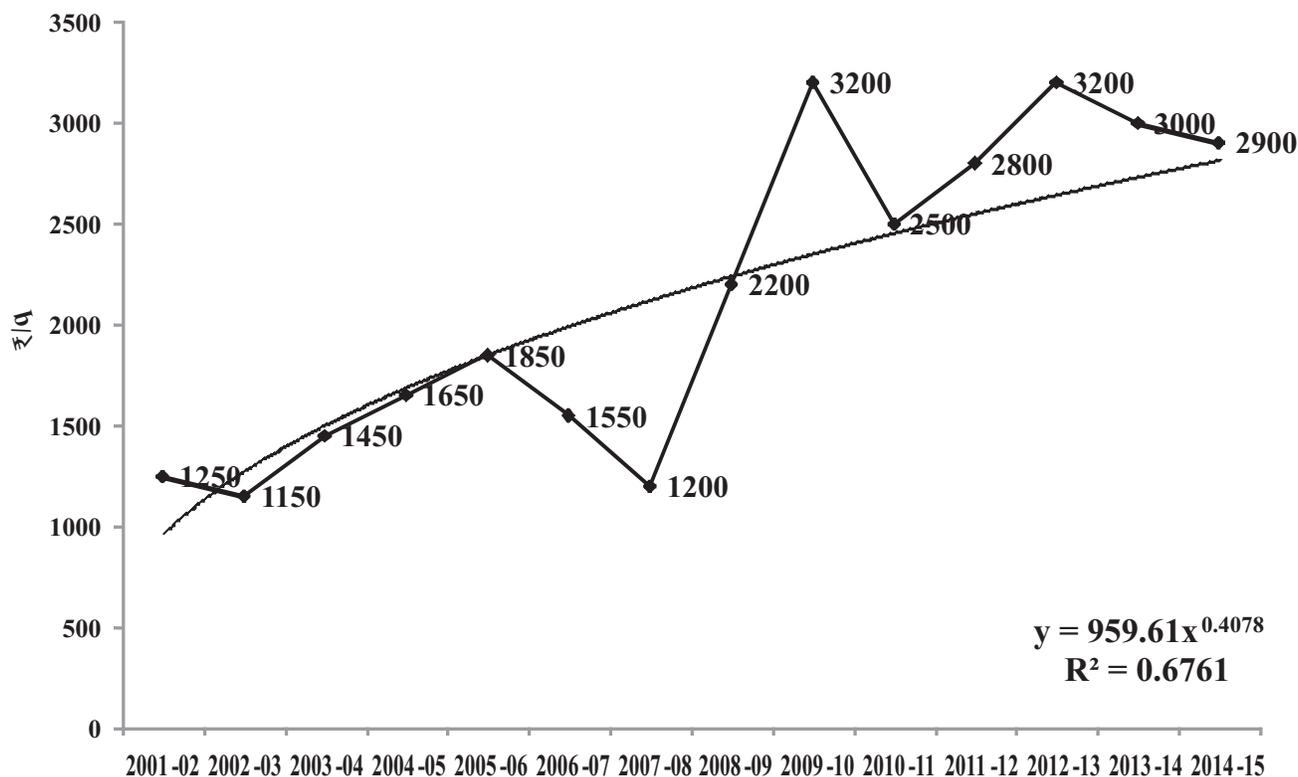
than 70 per cent to the production of the world. It is being exported to many countries like, Bangladesh, Great Britain, Canada, Chili, Egypt, Fizzy, Iran, Iraq, Kuwait, Malaysia, Nepal and USA.

As per the export trends maximum exports from India has been attributed to Nigeria with (₹29,004.15) followed by Kenya, Sudan, Nepal, United Arab Emirates, Malaysia, Mozambique, Togo, United States and Angola. Contrary to the quantity exported the value generated differs as Nepal has the highest value generated with ₹9,936.75 lakhs) followed by Nigeria, United Arab Emirates, Kenya, Sudan, United States, Togo, Malaysia , Angola and Mozambique. The chief reason being variation in export trends arising out of macroeconomic variations.

The factors considered by wholesalers and exporters of the selected markets while pricing of jaggery are presented in Table 2. The perusal of Table 2 revealed that factors like colour, packaging, uniformity, taste, texture, structure, season, size and flavour of the jaggery prices were equally preferred by both the respondents in fixing the price range for jaggery in the study area, while wholesalers point of view colour, packaging, uniformity are major factor to determine jaggery prices and exporters point of view season, colour, packaging major factor to determine jaggery prices on the basis of assessment using Garrett ranking technique.

**Identification of Major Constraints Faced by Jaggery Producers, Wholesalers and Exporters**

The major problems in the study area were identified both for working and non-working jaggery producers. The major problems were price fluctuations, non-availability of suitable



**Figure 1: Trend analysis for sugarcane production**

**Table 2: Factors affecting jaggery prices**

Factors	Wholesalers		Exporters	
	Rank	Garratt score	Rank	Garratt score
Colour	1	597.60	2	76.77
Packaging	2	248.40	3	74.11
Uniformity	3	165.60	5	55.44
Taste	4	71.00	6	45.22
Texture	5	56.00	7	44.88
Structure	6	51.20	8	34.88
Season	7	44.50	1	84.66
Size	8	40.90	4	58.88
Flavour	9	20.40	9	25.88

Source: Researcher's compilation from field data

**Table 4: Constraints faced by jaggery wholesalers**

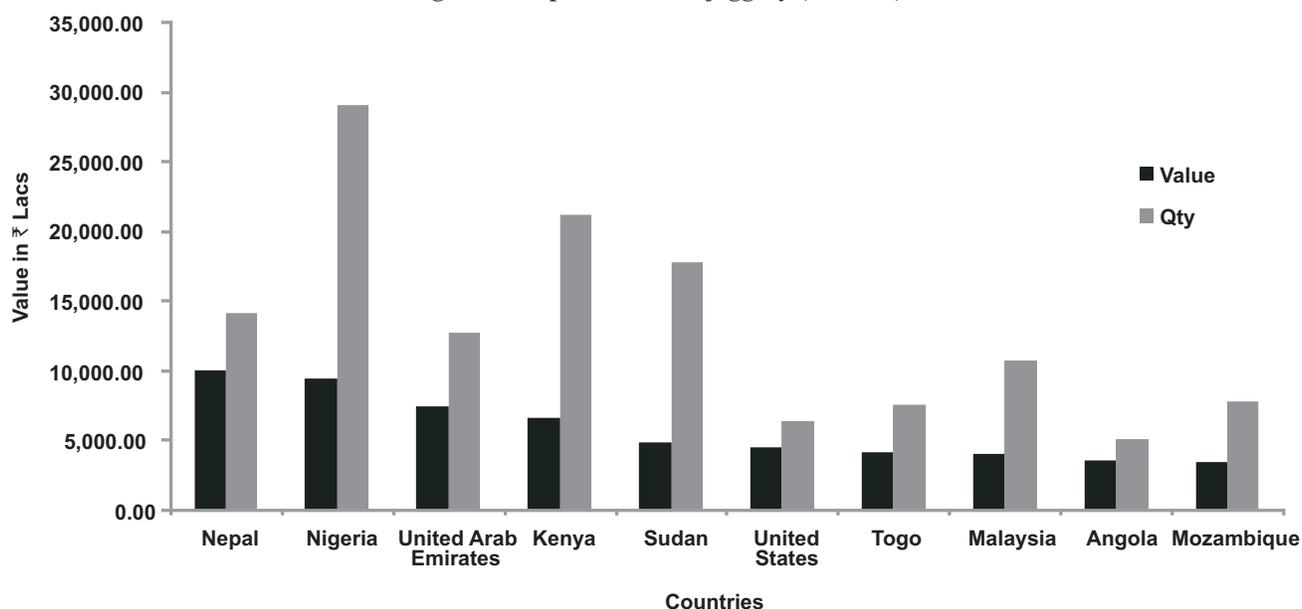
Parameter	RBQ mean	Rank
High fluctuation in prices	94.28	1
High commission charges	85.71	2
Malpractices in transportation	80.00	3
Delay in payments	51.42	4
Lack of facilities	45.71	5
Lack of quality of Jaggery	25.71	6
Mutual understanding between SCSSGKVS and commission agents	20.00	7

**Table 3: Constraints faced by jaggery producers**

Parameter	Working		Non-working	
	Rank	RBQ mean	Rank	RBQ mean
Price fluctuation	1	95.60	2	83.66
Non-availability of suitable sugarcane varieties	2	84.60	5	65.00
Labour scarcity	3	82.20	1	93.00
Climate related problems	4	72.60	4	75.33
Electricity problem	5	64.60	7	42.00
Non-availability of technical know-how	6	44.80	3	81.33
High setup cost	7	42.00	6	44.00
Non-availability of chemicals	8	32.00	9	15.66
Lack of better equipment's	9	17.40	10	15.00
Lack of infrastructure facility	10	14.60	8	36.33

Source: Researcher's compilation from field data

**Figure 2: Export status of jaggery (2014-15)**



Source: www.apeda.gov.in

**Table 5: Constraints faced by jaggery exporters**

Parameter	RBQ mean	Rank
Price fluctuation in international markets	93.75	1
Lack of quality products	76.25	2
Lack of export incentive	76.15	3
Fluctuation in international demand	71.25	4
Delay in payments	51.25	5
High procedure formalities	31.25	6
High export duties	25.00	7
Transportation facility (production unit to port)	18.75	8

sugarcane varieties, labour scarcity, climate related problems, electricity problems, non-availability of technical know-how, high setup cost of production facilities, non-availability of chemicals, lack of better equipment and lack of infrastructure facility. These problems were ranked using RBQ mean based on severity.

The major problem of working producer was price fluctuation, which is ranked first followed by non-availability of suitable sugarcane varieties with second rank and labour scarcity with third rank. For non-working producers, the main problem was labour scarcity followed by price fluctuation and non-availability of technical know-how. Many of the producers were shifted from jaggery production to some other business due to combined effect of these problems.

The major constraints faced by the wholesalers in the study area are identified and ranked based on the basis of RBQ technique. The major problems are high fluctuation in prices (94.28), high commission charges (85.71), malpractices in transportation (80.00), delay in payments (51.42), lack of facilities (45.71), lack of quality of Jaggery (25.71) and mutual understanding between SCSSGKVS and commission agents (20.00). Of these problems, most severe was high fluctuation in prices, which ranked first followed by high commission charges, malpractices during transportation and delay in payment. These problems can be solved through organised marketing.

The major problems analyzed in the study area at exporters' level are price fluctuation in international markets, lack of quality products, lack of export incentive, and fluctuation in international demand, and delay in payments, high procedure formalities, high export duties and transportation facility (production unit to port). Among these problems, most severe was price fluctuation in international market (93.75), which ranked first followed by lack of quality products (76.25), lack of export incentive (76.15) and fluctuation in international demand (71.25), which ranks second, third and fourth respectively.

#### CONCLUSIONS AND RECOMMENDATIONS

The area under sugar cane production is increasing over

year except 2010–11 in Kolhapur district of Maharashtra. The prices for Kolhapur jaggery is expected to be ₹2895.375 per quintal and ₹2972.589 quintal for the year 2015–16 and 2016–17 respectively. There were various factors taken into consideration while determining jaggery prices. Wholesaler mostly preferred color, packaging, uniformity, etc. for determine prices of Jaggery while exporters mostly preferred season, color, packaging, etc. for determine prices of jaggery. The major problems were high fluctuation in prices, high commission charges, malpractices in transportation, delay in payments, lack of facilities, out of these problems, most severe was high fluctuation in prices, followed by high commission charges, malpractices during transportation and delay in payment. The problems faced by exporter level are price fluctuation in international market, lack of quality products, lack of export incentive etc. Among these problems, most severe was price fluctuation in international market, followed by lack of quality products, lack of export incentive and fluctuation in international demand, respectively.

Sugarcane producer can adopt cooperative farming to manage the shortage of labor, adaptation of farm mechanism. At the same time producer use information communication technology (ICT) in time to come up with risk of price fluctuation. The training and extension services should be provided to the jaggery producers by Jaggery Research Centre to have an idea of cost effective method of producing jaggery, increasing the quality of the product. It is suggested to bring the industry under cluster development programme, so that the producers and other agencies involved in the marketing of jaggery can have a better insight about the jaggery scenario in the region and can incorporate and adapt to the changes immediately.

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## Development and Economics of Artificial Additives Free Rose Syrup from Desi Rose

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### ABSTRACT

Roses are grown worldwide and have been used for landscaping, cosmetics and medicinal purposes since ancient time. It has been used extensively in the Indian medicine system of Ayurveda. In this study, a process was standardized to produce the 100 percent natural rose syrup by utilizing the fresh rose petals and cane sugar. The principle of osmosis was used to produce syrup along with the standardization of temperature/time conditions. The resultant product gives a TSS of 65.20°B which is as per the FSSAI standards for the syrups. The product is also rich in phenols (625 mg//100g), anthocyanins (21.16 mg/100g) and antioxidants (24.53 per cent) and provides refreshing taste of natural rose. It scored a higher overall acceptability (8.7) among the consumers when compared with the other market available rose syrups on a 9 point hedonic scale. The cost of production is less or similar to that of other syrups i.e. ₹63/750 mL and can be sold in the market at a price of ₹96/750 mL with a good margin of profit. Thus it provides an economic health tonic without artificial additives.

### Keywords

Economics, health, petals, rose, syrup

### JEL Codes

D40, O10, 014, 032, Q18

### INTRODUCTION

Rose is known as the king of flowers and has been known for its fragrance and beauty since time immemorial. *Rosa spp.* is diverse and at present over 200 species and more than 18000 cultivars form of the plant has been identified. The health benefits of the rose are well known and several pharmacological properties including anti-HIV, antibacterial, antioxidant, antitussive, hypnotic, antidiabetic, and relaxant effect on tracheal chains have been reported for this plant Boskabady *et al.* 2011). Roses have always remained attention catching and has been used as a cooling agent and as a vehicle for other medicines Kaul (1998). Owing to its health benefits rose has won the title of 'Herb of the year' in 2012.

In India, a well-known process for the production of rose petals preserve (*Gulkand*) has been practiced from ancient times. *Gulkand* has been used as a sweetener in *Paan* and is a carrier for several ayurvedic medicines. A fragrant syrup "Gulkand Sharbat" is also produced by boiling the rose petals with sugar and water in specific

proportions. However, the traditional process for *Gulkand* production is a long process involving the principle of osmotic extraction and takes near about 29 days to complete. In the case of *gulkand sharbat* a relatively high temperature is used which results in the loss of natural aroma, flavor and color of the product. The resultant product is brownish in color and loses its natural identity to several extents. Although nowadays market is full of rose syrups but they generally contain the synthetic coloring agent such as azorubine, carmoisine (E-122), Pinceau-4R (E-124) and erythrosine (E-127) and chemical flavoring compounds such as geranyl acetate and geraniol are used. These synthetic colouring as well as flavouring compounds do not give any health benefit and might produce certain allergies, hyperactive disorders in children and may also cause cancer. The synthetic food colours have an adverse effect on some of the biochemical analysis; and the liver and kidney histopathological structure (Soltan & Shehata, 2012).

In the present study, a process has been standardized to produce the natural rose syrup and is subjected to

physicochemical and sensorial evaluation. Further, an economic analysis has been done for the cost of production and this has been compared with such commercially available products.

## MATERIALS AND METHODS

### Collection of rose petals

Fresh petals of *desi rose* were collected from the department of Floriculture and Landscaping, Punjab Agricultural University, Ludhiana. The petals were collected on a clear sunny day after the evaporation of dew.

### Sugar

Crystalline table sugar (sucrose) was used to carry out the study. The sugar was purchased from the local market, PAU, Ludhiana.

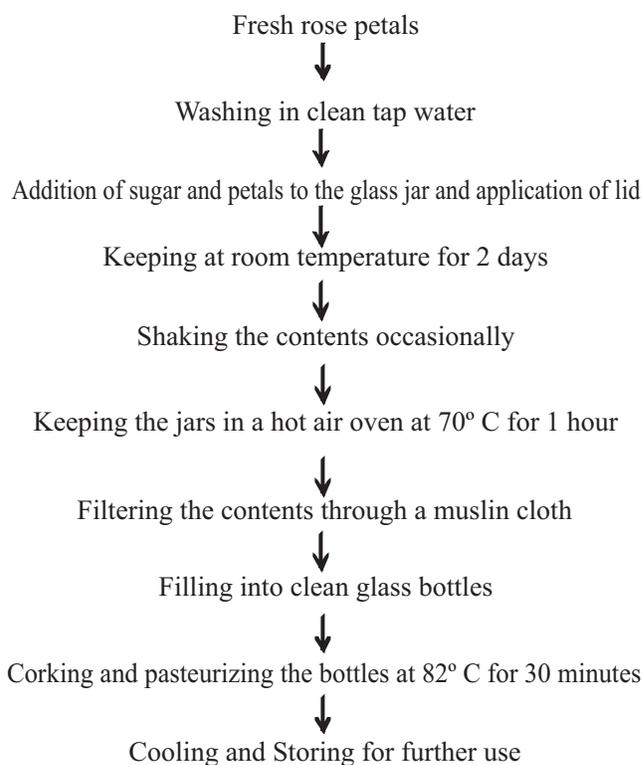
### Optimization process

The process was standardized in two steps. In the first step, the ratio of flower petals to the sugar was optimized so as to obtain syrup with a good aroma, color and total soluble solids (TSS) close to 65°B. Different ratios of rose petals and sugar were selected by considering the FSSAI standards, colour, aroma and taste of the final product. In total six treatments were selected covering the percentage from 24:76 to 34:66. In all the treatments rose petals were added in subsequent layers in glass jars of 2-liter capacity. After the tight filling of the jar, the lid was applied and kept at room temperature for the slow dissolution of sugar. It was shaken several times for better mixing of sugar. The osmosis resulted in the extraction of water, pigments, and flavor from petals and mixing into syrup. After two days the temperature was increased to 100°C and was kept at this temperature for the complete mixing of sugar. The heat resulted in the better extraction of pigments and aroma into the syrup. After the completion of extraction, the syrup was filtered through a muslin cloth, packaged into glass bottles and pasteurized.

In the second step of standardization, the effect of temperature was studied. The selected treatment (30:70) from the first step was further subjected to various temperatures i.e. 70, 80, 90 and 100°C and the effect of temperature was studied. Based on the physicochemical and sensory attributes the best treatment was selected and the product was produced in bulk on the basis of this standardization. The standardized process was reviewed for its economic attributes like the cost of production, possible minimum sale price and its comparison with the market existing products.

### Physico-chemical analysis

Total soluble solids (TSS) were determined using hand refractometer after correcting the readings for temperature variation. The results were expressed as degree Brix (°B). The total solids content was measured by evaporating the moisture of pre-weighed sample in a hot air oven at 70°C. Titrable acidity was measured by the method of AOAC (1980). pH was measured with Oakton digital pH meter. Ash content was measured by heating the pre-weighed sample in a muffle furnace at 525°C for 6 hours. Total anthocyanins were measured using the



**Figure 1: Schematic diagram for the production of rose syrup**

ethanolic HCl as per the method given by Ranganna. The ascorbic acid measurement was done by using titrimetric method against the DPPH dye Ranganna (1986). Total phenols were estimated using the spectrophotometer at 760nm Singleton & Rossi (1965). Colour was determined using Hunter color lab and the value of the colour was presented as 'L' (lightness), 'a' (redness) and 'b' (yellowness). The value of L varies from 0-100; higher the value of L whiter the product and lower the value of L indicates black. The positive value of 'a' indicates redness and a negative value indicates greenness. The positive value of the b indicates yellowness and the negative value indicates blueness.

### Sensory analysis

Coded samples of the newly developed rose syrup were given to sensory panel for evaluation along with the pre-established market rose syrup brands after diluting with 4 times of potable water and were asked to rank the intensity of each attribute of product on a 9 point hedonic scale. Where 1 means 'dislike extremely' and 9 means 'like extremely'. The judges rinsed their mouth with water in-between the testing of products.

### Economic analysis

The economic analysis of the product was done for the 750 ml of the product. An average of the annual price of the rose and sugar was taken for the estimation of the production cost. The cost was further compared with the market available rose syrups.

**RESULTS AND DISCUSSION**

Table 1 represents the physicochemical characteristics of the syrup. The standardized recipe yielded 681±20.2 mL rose syrup of 65.20±0.26°B which is at par with the FSSAI standards of minimum total soluble solids of 65 °B in rose syrup FSSAI (2010). The syrup had a total solid content of 66.13±0.40 per cent. The product has a very low acidity (0.0011 per cent) and a neutral pH of 6.86±0.02. The low acidity and neutral pH of the product are due to the fact that rose does not have the acidity of its own and no citric acid was added during the process to retain the natural flavour of the rose. The product was rich in total phenols and anthocyanins and had a content of 102.1±4.6721.16±0.30mg/100g, respectively. The product had a good ascorbic acid content of 34.87±2.73mg/100g and antioxidant activity of 24.53±0.76 mg/100g.

**Table 1: Physico-chemical analysis of lab prepared rose syrup**

Parameters	Content
Syrup recovery (ml)	681±20.20
TSS (° B)	65.20±0.26
Total solids (per cent)	66.13±0.40
pH	6.86±0.02
Ash (per cent)	0.3±0.10
Acidity (per cent)	0.0011
Total phenols (mg/100g)	625±6.2
Antioxidant activity (per cent)	24.53±0.76
Anthocyanins (mg/100g)	21.16±0.30
Ascorbic acid (mg/100g)	34.87±2.73
Color values mapping	
L*—lightness	37.31±0.02
a*—+ red; –green	0.67±0.058
b* —+ yellow; –blue	-2.31±0.006

The product had a lightness value of 37.31±0.02 i.e. it has a darker colour. The 'a' and 'b' value were 0.67±0.058 and -2.31±0.006, respectively. These values showed that the product has a reddish and bluish colour. The intensity of the blue and red colour is due to the presence of the anthocyanins. The anthocyanins range from red to blue colour, and is responsible for the color of many fruit and vegetables (Mazza & Miniati, 1993).

**Table 2: Sensory comparison of laboratory prepared rose syrup with market available rose syrups**

Product	Appearance	Consistency	Flavour	Overall acceptability
Lab made rose syrup	7.7±0.5	8.7±0.3	9.0	8.7±0.53
Mausam rose syrup	8.0±0.2	7.0±1.0	7.0±1.2	7.2±0.56
Hamdard sharbat rooh afza	8.5±0.5	8.2±0.7	7.8±0.5	7.8±0.44
Shergill's rose sharbat	8.2±0.5	7.5±0.6	7.2±0.7	7.5±0.45

The product has a good sensory profile (Table 2) and was liked extremely by the consumers. The consumers reported a fresh refreshing taste of rose in this syrup similar to that of fresh rose petals. However, the product fetched a slightly low score for appearance than the market syrups. This is due to the fact that market syrups contain synthetic dyes such as azorubine, carmoisine which impart a bright red colour to these products. A problem of slight bitter after-taste was also reported by some consumers but at the same majority of consumers supported its bitter aftertaste by quoting that it strengthens the natural concept of syrup. The Lab prepared syrup was liked mostly for its excellent natural flavor and refreshing quality. The market syrups fetched a low score because the dyes interfere with the flavor of these syrups and had an artificial flavor perception.

**Economic Analysis**

Roses have been used since time immemorial for their culinary, cosmetic, aromatic and medicinal properties Sharma *et al.* (2011). In India the medicinal concept of roses has been explored since ayurvedic era and is being used for various health purposes. Traditionally the plant pacifies vitiated *VATA*, *PITTA*, inflammation, burning sensation, conjunctivitis, cough, skin disease, cardiac disability, fever, and general weakness Jena *et al.* (2012). A number of rose based products including the syrups are available in the Indian market. These days a number of synthetic syrups are also present in the market, therefore, the price of rose syrups varies from ₹80 to ₹ 300 per bottle of 750 mL. In this study firstly the production cost of natural rose syrup from the fresh rose petals was calculated and then compared with such market products (Table 3).

**Table 3: Production cost of natural rose syrup from fresh rose petals**

Attributes	Cost (approx.) (₹)
Fresh rose petals (@₹50/Kg)	20
Sugar (@₹40/Kg)	33
Labour and processing cost	03
Bottling and labeling	07
Total production cost	63
Minimum sale price (with 40 per cent overhead charges+ 10 per	96.4

**Table 4: Comparison of additives and maximum retail prices of laboratory prepared rose syrup to the locally available rose syrups**

Rose syrup brand	Quantity (mL)	Artificial additives declaration	Maximum retail price (₹)
Laboratory Made Rose Syrup	750	No artificial colour	96.00
Mausam Rose Syrup	750	Not mentioned on label but contains artificial colours	140.00
Hamdard Sharbat Rooh Afza	750	INS-122, INS-102, INS-211	130.00
Shergill's Rose Sharbat	750	Contains permitted food colours and added flavor, E-211, E-330	125.00

**Table 5: Comparison of retail price of some of the rose syrup brands**

Brand	Quantity (mL)	Sale price/pack ₹	Source
Monin rose syrup	750	6950	Amazon.in
Jrc rose syrup	680	358	ShopClues.com
Pureberrys rose syrup	750	249	Amazon.in
Vega rose syrup	1000	190	Indiamart.com
Mishrambhu rose syrup	750	125	Indiamart.com
Fruitoman's rose syrup	750	125	Indiamart.com

The cost of production for the natural rose syrup is same or lower than most of the synthetic syrups in the market. This is owing to the fact that synthetic rose syrups made use of the rose gel '*gulabgal*' to impart aroma to the syrup. The process of aroma collection is an expensive process and hence it increases their overall production process. The sale price of the product is always 35 to 50 per cent higher than the production cost so as to meet various taxes, transportation cost and sales commissions. Therefore, the market price of the product was calculated by adding 40 per cent of overhead charges + 10 per cent of sales commission and then it was compared with the market available rose syrups.

#### Price comparison with other top rose syrup brands

Food is something more than a need and a good food was always a delicacy. The market is full of variety foods and food products are sold according to their quality and grade. A good grade product always fetches a high price. Similar is true for rose syrup and the price of different brands vary a lot. Table 5 represents a comparison of the price of some of the major rose syrup brands.

From Table 4 and 5 we can see that the price of rose syrup varies from ₹ 125.00 to ₹ 695.00 in the Indian market and hence there is a huge scope for natural additive free products. The newly developed technology offers an economic method to develop an artificial additive free hundred percent natural rose syrup. This technology can provide a tough challenge to the existing players and can be proved a bone for the Indian farmers.

#### CONCLUSIONS

The lab prepared rose syrup is a 100 percent natural product as it does not contain artificial colour, flavour, and preservatives. It contains the true essence of the rose and

gives a refreshing taste of the fresh rose. The use of fresh petals also makes it rich in phenols and antioxidants and thus making it a health tonic. On the other hand, the artificial colours like azorubine, carmoisine (E-122/INS-122), Tartrazine (E-102/INS-102) used in market syrups are related to asthma, allergy, hyperactivity and rashes Siva (2014). Thus this newly developed process provides a 100 percent natural rose tonic to the consumer at a cheaper rate with several health benefits over the market available products. The process is simple and can be easily applied at household as well as industrial level. The production of natural, additive free product with highly acceptable sensory attributes can provide a tough competition to the existing products.

#### ACKNOWLEDGEMENTS

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## An Economic Analysis of Value Addition of Paddy into Flakes Rice in Balodabazar-Bhatapara District of Chhattisgarh

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### ABSTRACT

The paddy value addition study was carried out in June-August 2014-15. A representative sample of paddy processors (millers) was sampled and interviewed using a structured schedule. Results showed that at the total value added cost of paddy in flakes rice was involved to be ₹254 per q. During the processing of flakes rice, the major cost was registered in bagging of flakes rice and found to be 39.37 percent followed by machine labour (35.79 per cent), electricity (10.59 per cent), loading and unloading charges (9.05 per cent) and transportation (5.20 per cent), respectively. The major constraints affecting was technical labour problem and reported by 90 percent processors.

### Keywords

Chhattisgarh, constraints, flakes rice, paddy, value addition

### JEL Codes

C82, C83, O13, Q12, Q13 Q18, Y10

### INTRODUCTION

Rice is the basic grain consumed as a food in India, which is found in almost every Indian kitchen. It is the most common cereal and the most common food in India. However, India is not only a big consumer of rice but also it is the second largest producer of rice in the world after China. About 3 billion people, nearly half the world's population, depend on rice for survival. In Asia as a whole, much of the population consumes rice in every meal.

Rice production, processing and marketing constitute the biggest industry in the country. Due to direct sale, small holdings and low productivity of rice, growers are not receiving higher income, but there is one way to enhance the income by value added product/processed products of rice like poha, parboiled rice and non-parboiled rice.

In the value added by processing of paddy into poha (flakes rice) was found to be ₹572 per quintal which indicated that through processing poha, value was added and it was seen that poha business was more profitable than raw rice and boiled rice (Bhagat, 2010).

It was observed that there is further scope for

expanding paddy processing industry without increasing productivity of paddy per unit area (Gautam *et al.*, 1988).

It was found that the average processing cost worked out to be ₹12241.05 and 7716.71 per unit of huller and rice mill respectively (Pawar *et al.*, 1990).

In study found that the poor quality of raw materials due to higher moisture content especially in the early arrival of paddy and harvesting of paddy through harvest combines, delay in announcing levy prices by the Central Government, demand for gratification while accepting rice by procurement agencies, etc. public agency on the owner hand faced difficulties in getting their paddy milled at proper time were major problems faced by rice mill owners (Sekhon *et al.*, 2003).

Rice Flakes or Poha (also called beaten rice) is de-husked rice which is flattened into flat light dry flakes. These flakes of rice swell when added to liquid, whether hot or cold, as they absorb water, milk or any other liquids. The thicknesses of these flakes vary between almost translucently thin (the more expensive varieties) to nearly four times thicker than a normal rice grain.

The Bhatapara is famous for rice flake (poha) production and including of 100 rice flake (poha) mills are

functioning. The district is primarily involved in the value addition of rice as well as their products especially flakes rice. So, in view of this a present study have undertaken with the following specific objectives:

- i. to examine the value addition of flakes rice (poha) and
- ii. to study the constraints involved in value addition of flakes rice.

#### MATERIALS AND METHOD

The study was conducted in Balodabazar–Bhatapara district of Chhattisgarh. Bhatapara block was purposively selected, the block having 100 flakes rice (poha) mills, out of this, 10 flakes rice mills were selected randomly for present study. The data on value addition aspects of rice were collected through pre-structured schedule. The study is based on primary data collected initially from flakes rice processor on the value addition, which were collect on schedule design for the study. The simple averages and percentage statistical tools were applied to analyze the data and report the results/outcomes of objectives framed for the study (Shwetha *et al.*, 2011).

#### RESULT AND DISCUSSION

##### Value Addition of Paddy into Flakes Rice at Processor Level

The value addition of paddy into flakes rice at processor level was computed in ₹per q, (Table 1). It reveals that purchased price at processor level of paddy as raw material was observed to be ₹1360 per q. The paddy was processed into flakes rice by processor. The processed flakes rice was sold at price ₹2500 per q. The total value added cost of paddy in flakes rice was ₹254 per q. The cost of processed paddy into flakes rice was found to be ₹1614 per q. During the processing of flakes rice, the major cost was registered in bagging of flakes rice and found to be 39.37 percent followed by machine labour (35.79 per cent), electricity (10.59 per cent), loading and unloading charges (9.05 per cent) and transportation (5.20

per cent), respectively. The share of paddy as raw material was 84.26 percent whereas, the share of total value added cost was found to be 15.74 percent. The processors obtain the value added margin of paddy into flakes rice was ₹886 per q. The findings of the study indicated that processing of paddy into flakes rice is profitable business activity.

##### Constraints faced by processors of flakes rice

Among the eight major constraints related to processing of paddy into flakes rice, technical labour problem was reported by 90 percent processors while raw material non availability was reported by 60 percent which was second major problem. Electricity, storage, transportation, financial, water and management of processing plant were also problem during processing of flakes rice and found to be 50, 40, 30, 20, 20, and 10 per cent respectively (Table 2). Similar findings were also reported by Amrutha (1994); Aitawade *et al.* (2006)

Thus it could be concluded that efforts are needed to solve the above mentioned problems then profit might be increased and the efficiency of value chain of flakes rice might be increased in the study area.

#### CONCLUSIONS

Table 2: Constraints faced by processors of flakes rice

(N=10)	
Constraints	Per cent
Financial problem	20
Transportation problem	30
Electricity problem	50
Technical labour problem	90
Raw material availability	60
Management problem	10
Storage problem	40
Water problem	20

Table 1: Value addition of paddy into flakes rice at processor level

Particulars	Cost (₹/q)	Percentage of total value added cost	Percentage of operational processing cost
(A) Cost of unprocessed paddy	1360.00	84.26	–
(B) Cost of processing			
1. Transportation	13.20	0.82	5.20
2. Loading–Unloading	23.00	1.43	9.05
3. Electricity	26.90	1.67	10.59
4. Machine and labour	90.90	5.63	35.79
5. Bagging	100.00	6.19	39.37
<b>Total value added Cost</b>	254.00	15.74 (100)	[100]
(C) Cost of paddy up to processing (A+B)	1614.00	–	–
(D) Selling price of processed flakes rice	2500.00	–	–
<b>(E) Value added margin of paddy to flakes rice (D-C)</b>	886.00	–	–

The purchased price at processor level of paddy as raw material was observed to be ₹1360 per q., the total value added cost of paddy in flakes rice was involved ₹240.50 per q., the cost of processed paddy into flakes rice was found to be ₹1614 per q., the processors obtain the value added margin of paddy into flakes rice was Rs. 886 per q. The technical labour problem was first with 90 percent while raw material availability problem was 60 per cent.

#### **SUGGESTIONS**

Processing of paddy in the form of flakes rice is profitable business so more number of processing plant can be established, that will be help full to improve the economic condition of people up to some extent in the study area. On the basis of net differential gain in paddy processing, it is recommended that instead of selling only paddy grain by the producers, they should adopt the processing and then sell the product, which will be helpful for increasing the income. Skilled labour problem was major problem for most of the processing plants. So it is urgently required to arrange training programmers by various organizations to train the person.

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## Economic Evaluation of Functional Goat Meat Patties to Supplement Farm Returns

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### ABSTRACT

The sensory evaluation and economics for the development of functional goat meat patties using various levels of algal DHA oil (ADO) was worked out with an aim to harness the resource of goat population of the country and demand of functional foods in national and international markets. The protocol for product manufacture was finalised after standardisation of formulation and process. ADO was added at three different levels viz. 0.5per cent, 1.0per cent and 1.5per cent (T1, T2 and T3 respectively) for comparison with control. The sensory scores of T2 group was highest ( $P<0.05$ ) for overall acceptability and was selected for production and the economics was worked out for comparison with control. The net return and the margin of safety increased and the break even output was achieved earlier in the T2 group compared to control for 20 kg daily capacity of finished product. The benefit cost ratios were equal for both the groups. On scaling up the business to 100 kg/day production, returns were higher, break-even output was achieved quite earlier and margin of safety increased compared to 20 kg/day production indicating higher profitability of the business at large scale. The adoption of manufacturing of functional goat meat patties as business enterprise can help in generating income and employment in the era of increasing demand of agricultural diversification towards allied enterprises.

### Keywords

Break-even output, DHA, fixed cost, functional patties, variable cost

### JEL Codes

Q12, Q13

### INTRODUCTION

Goat meat is one of the widely consumed meats throughout the world, especially in developing countries (Pennstate Extension, 2016). One reason of the universal popularity of goat meat is that it is accepted by all the communities throughout the world without any inherent biasness. India has 135.17 million goat population (Anonymous, 2012) and ranks first in the world. Demand for goat meat in Indian domestic market is very high. Goat meat production in the country has increased from 0.47 to 0.59 million tons during the last decade (2002 to 2011) with an annual growth rate of 2.4 per cent and is second largest producer of goat meat in the world accounting 12 per cent production (Anonymous, 2015-16). The exports of sheep and goat meat has been showing a constant increase year by year and valued as ₹694.10, ₹828.11, and ₹837.75 crores for years 2013-14, 2014-15 and 2015-16,

respectively. However, the exports of processed meat has declined correspondingly from 508 quintals in 2013-14 to 405 and 282 quintals in 2014-15 and 2015-16, respectively (Anonymous, 2016).

It is an established principle of economics that processing adds value to the produce and increases its monetary returns. All this creates an excellent opportunity for Indian meat processing industry to produce processed meat products that would not only harness the livestock wealth of the country but also boost exports, earn valuable foreign exchange and increase the contribution of livestock sector in GDP. Producing the livestock products as per the emerging global needs and demand with in considerations of its preference is of utmost importance.

The nutritional diseases of affluence like CVD, obesity, diabetes etc. are capturing the focus of food scientists around the globe. Consumption of omega-3

polyunsaturated fatty acids ( $n-3$ PUFAs), such as eicosapentaenoic acid (EPA; C20:5) or docosahexaenoic acid (DHA; C22:6), has been reported to have beneficial effects on human health, such as lowering blood cholesterol and reduced risk of several diseases (Hammer & Schieberle, 2013). The main benefits associated with EPA and DHA fatty acids are their anti-inflammatory properties (Vedin *et al.* 2008; Furuholm *et al.*, 2009) cardiovascular protective effects (Kris-Etherton *et al.*, 2002; Dawczynski *et al.*, 2010), delaying of the onset of age associated neurological degeneration (Dangour *et al.*, 2012) and reduction of the risks for certain cancers (Seo *et al.*, 2005). But DHA oil tends to have characteristic fishy flavour that limits its levels in the meat products. Therefore, with the aim to harness the opportunity in global and domestic functional food market, formulation of DHA fortified goat meat patties was standardised, and its production cost was computed so as to establish its economic viability.

In the present scenario, the farmers of Punjab are not relying on agriculture alone and are adopting the subsidiary enterprises. Meat processing can be promising option in providing regular income and employment to the farmers. For making livestock farming more profitable and viable enterprise, converting meat into meat products at farm level is a good option. For small and marginal farmers who cannot invest more in the initial stage, manufacturing products like goat meat patties can be started with low initial investment. Taking all this account the present study was envisaged in determining the cost and returns associated with manufacturing of goat meat patties at two different scale levels.

#### MATERIALS AND METHODS

The study was conducted in the Department of Livestock Products Technology, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab, India.

**Assumptions:** The current study of economics was taken up following certain assumptions.

- i. The farm enterprise is maintaining its own goat farm for ensuring regular supply of stock for processing.
- ii. Market for the meat product produced was locally available and needed no marketing channels or cold chain.
- iii. The developed product was high in demand due to increasing level of disposable income and urbanization owing to industrial region and increasing level of health consciousness and awareness about functional foods.
- iv. Laborers were engaged @ ₹280 per day and cost of management personal was not taken into consideration.
- v. Utilization of by-products was not taken into account.
- vi. Material used in preliminary trials for standardization of formulation was not taken into account.
- vii. Price of the control product was fixed at ₹380 per kg taking into consideration the price of raw goat meat prevalent in the unorganised market in India, and price of functional product developed in the study was fixed @ ₹400 per Kg attributing it to its improved functionality.
- viii. Room rent was assumed as ₹0.75 Lakh per annum per hall for a floor space of 15" feet × 15" in suburbs, with water charges as ₹ 20 per day and electricity charges @ ₹6 per unit.
- ix. Cost of raw material and packaging material used were taken as per the on-going market rates at the time.
- x. Life of the equipments and machinery was assumed as 15 years and its salvage value was taken as 10 per cent of the initial cost.
- xi. Rate of interest on capital was taken as 12 per cent.

#### Formulas used

Cooking yield per cent =  $\frac{\text{Initial pre-cooked weight}}{\text{Final cooked weight}} \times 100$

Depreciation cost (Straight line method) =  $\frac{\text{Initial cost} - \text{Salvage value}}{\text{Total life in no. of years}}$

Contribution per unit =  $\frac{\text{Total revenue per unit} - \text{Total variable cost per unit}}$

Break-even output (units) =  $\frac{\text{Total Fixed costs per day}}{\text{Contribution per unit}}$

Cost-benefit ratio =  $\frac{\text{Gross returns per day}}{\text{Total cost per day}}$

Margin of safety =  $\text{Total output} - \text{Break even output}$

$$\text{Margin of safety (\%)} = \frac{\text{Margin of safety}}{\text{Total output}} \times 100$$

One year old Beetal goats weighing around 39 kg was procured from the Goat Farm, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana. The animals were slaughtered by humane method and external fat, fascia and other connective tissue were removed by hot deboning the carcass manually. The deboned meat was collected and chilled over-night at refrigeration temperature (4°C) and packed in low-density polyethylene (LDPE) bags of 200 gauge and kept at -18°C for use within three months of storage. ADO (DHA conc. 35 per cent) procured from V.B. Medicare Pvt. Ltd., Hosor, (T. N.), India, was stored at -18°C and used within the period of six months. Ingredients such as spices (for the formulation of spice mixture) and condiments (onion, ginger, garlic; 3:1:1) used for study were obtained from local markets. The spices were cleaned and dried in industrial drier at 60±2°C for 24 hours and then ground into fine powder separately using domestic grinder. The spice mix was prepared by mixing different spices as per the formulation (Appendix 2a) developed in laboratory and stored in a moisture free PET (polyethylene terephthalate) jar till further use. The condiment mix was prepared by mixing onion, ginger and garlic paste, respectively in 3:1:1 ratio (Appendix 2b).

Table salt (Tata Chemicals Ltd., Mumbai), and refined soybean oil (Fortune, Adani Wilmar Ltd) were procured from the local market.

**Technology of product preparation**

The frozen de-boned meat was thawed for 12-14 hours in refrigerator before it was cut into small pieces of about 1 inch<sup>3</sup> and minced once through 6 mm and then trough 4 mm plate in meat mincer (Mado Eskimo Mew-714, Mado, Germany). Bowl chopper (Model: TC11, Scharfen, Germany) was used for preparation of emulsion preparation.

**Formulation for preparation goat meat patties fortified with DHA**

The products were prepared by incorporating ADO at three different levels viz. 0.5per cent (T<sub>1</sub>), 1per cent (T<sub>2</sub>) and 1.5per cent (T<sub>3</sub>) along with control. Minced meat was chopped for one minute after mixing with salt, nitrite and sodium tetra pyro-phosphate (STPP). The mix was chopped for one more minute after mixing with Ice flacks (Table 1). The process of chopping was repeated for third time after addition of refined oil for one more minute and then the condiments, spices mix and ADO (except for control) were added and chopped for two minutes. Temperature was maintained below 10°C throughout the process by adding ice flakes. The final emulsion was then moulded into patties and cooked in a pre-heated oven at 180±5°C for 35 min. The product was intermittently turned upside down to attain better colour and appearance and to achieve the required core temperature of 72°C. The finally obtained cooked patties were brought to room temperature before the samples were collected for various analyses.

**Table 1: Formulation for preparation of goat meat patties incorporated with ω-3 fatty acid source (Algal DHA Oil)**

Ingredient (per cent w/w)	Control	Treatment		
		T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>
Goat meat	73.30	72.80	72.30	71.80
Fat	3.00	3.00	3.00	3.00
Chilled water	5.00	5.00	5.00	5.00
Textured soya protein	3.50	3.50	3.50	3.50
Spices	2.00	2.00	2.00	2.00
Salt	1.50	1.50	1.50	1.50
Refined wheat flour	3.50	3.50	3.50	3.50
Condiments	3.00	3.00	3.00	3.00
Sodium tetra poly phosphate	0.20	0.20	0.20	0.20
Sodium nitrite (ppm)	120.00	120.00	120.00	120.00
Whole egg liquid	5.00	5.00	5.00	5.00
Algal DHA Oil	0.00	0.50	1.00	1.50

*Formulation for patties included lean meat, refined wheat flour 3.5 per cent, texturized soy protein 3.5per cent, vegetable oil 3 per cent, spice mix 2.0 per cent and salt 1.5 per cent, sodium tetra-poly-phosphate 0.2 per cent and chilled water 5 per cent*

**Sensory evaluation**

The 8 –point descriptive scale (Keeton, 1983), with 8 denoted extremely desirable and 1 denoted extremely undesirable was used for sensory evaluation.

Protocol for the development of goat meat patties was standardised after repeated trials using different levels of ingredients of the formulation mix following principals of meat processing technology. The finalised formulation mix was adopted for manufacture of patties after standardisation of cooking time and temperature levels.

**RESULTS AND DISCUSSION**

To anticipate the response towards the manufactured product in market and to standardize the level of ADO fortification, sensory analysis was carried out comparing the four groups of product under trial. T2 group was rated highest (P<0.05) in over all acceptability among ADO treated groups and was picked for further economic analyses.

**Capital Investment**

Cost analysis for the manufacture of the product to evaluate the techno-economic feasibility of the technology at commercial scale was carried out so as to make it possible to start a small unit and a major step to provide an alternative to crop farming stick farmers. It will be quite easy for farmers to start their own manufacturing unit with this feasibility study. The different cost components comprising of a broad category of fixed, variable and total costs are broken into specific cost categories based upon the type of input needs. The capital investment, cost of fortified meat patties and profitability were estimated and the detailed break up of different cost components into per unit fixed, variable and total cost are presented and discussed in succeeding sections.

Capital investment of the project was worked out taking into account the permanent equipment's required for the establishment of processing plant to be installed to develop goat meat patties. All the necessary equipment's and their required numbers as well as cost involved are listed in the Table 2. It is revealed from the table that initial investment required to start a business of meat patties manufacturing worked out to be ₹386600.00 and ₹401100.00 for capacity of 20.00 kg and 100.00 kg meat patties respectively. Hence, there is very little difference in the initial capital required to start the business. The farmers can easily shift from 20.00 kg capacity to 100.00 kg capacity if the market demand is there.

**Fixed cost**

Fixed cost of the project was calculated by adding up the cost of the rent of the halls used, depreciation values of the equipment's used and interest born on the capital investment of the project (Table 3). Total fixed cost per annum was observed to be ₹144558 for 20.00 kg capacity and ₹221198 for 100.00 kg capacity. The major component of the fixed cost was rent of hall (₹75000 for 20.00 kg capacity and ₹150000 for 100.00 kg capacity) followed by interest on capital (₹46392 and ₹48132

**Table 2: Capital Investment required for goat meat patties manufacturing business**

Particulars	(₹)					
	20.00 kg capacity			100.00 kg capacity		
	Quantity	Rate	Cost	Quantity	Rate	Cost
Refrigerator	1	30,000.00	30,000.00	2	20000.00	40000.00
Hot air oven	1	16,000.00	16,000.00	1	16000.00	16000.00
Meat mincer	1	1,80,000.00	1,80,000.00	1	180000.00	180000.00
Bowl chopper	1	1,50,000.00	1,50,000.00	1	150000.00	150000.00
Sealing machine	1	5,000.00	5,000.00	1	5000.00	5000.00
Stainless steel tables	1	4,000.00	4,000.00	2	4000.00	8000.00
Knife set	1	1,000.00	1,000.00	1	1000.00	1000.00
Pattie moulds	10	10.00	100.00	10	10.00	100.00
Aluminium trays	5	100.00	500.00	10	100.00	1000.00
<b>Total</b>			<b>3,86,600.00</b>			<b>401100.00</b>

**Table 3: Fixed cost involved in goat meat patties manufacturing**

Particulars	(₹)			
	20.00 kg capacity		100.00 kg capacity	
	Rate	Amount	Rate	Amount
Rent of hall	75000 per annum	75000.00	150000 per annum	150000.00
Equipment depreciation		23196.00		24066.00
Interest on capital (per cent)	12.00	46392.00	12.00	48132.00
<b>TFC/year</b>		<b>144588.00</b>		<b>222198.00</b>
<b>TFC/month</b>		<b>12049.00</b>		<b>18516.50</b>
<b>TFC/day</b>		<b>396.13</b>		<b>608.76</b>

TFC = Total fixed cost; Expected life of equipments = 15 years; Salvage value = 10 per cent

respectively) and depreciation on equipment (R ₹23196 and Rs 24,066 respectively). Further, the fixed cost per day came out as ₹396.13 and ₹608.76 for 20.00 kg and 100.00 kg capacity respectively.

#### Variable cost

For the calculation variable cost of the project, the cost incurred on the variable components of production were summed up, viz. cost of raw material, electricity charges, packaging material, water bills and miscellaneous expenses (Table 4). The ingredients were purchased from the local market and the cost was calculated based on their ongoing market prices. In 20.00 kg capacity plant, the total variable cost per day worked out to be ₹6425.83 for control (normal meat patties) and ₹6753.33 for fortified meat patties (T2). The major item of expenditure was raw goat meat followed by labour. Similarly, for 100.00 kg capacity plant, total variable cost per day was observed to be ₹30956.98 for normal meat patties and ₹32,595.98 for fortified meat patties. Again the main item of expenditure was raw goat meat followed by labour expenditure.

#### Total cost

Total cost of production was worked out by adding up the amounts incurred as fixed and variable cost. The results tabulated in Table 5 revealed that production cost increased when treated with algal DHA oil. In the case of

20.00 kg capacity, total cost per day worked out to be Rs 6821.96 and Rs 7149.46 respectively for control and fortified meat patties. The respective per kg total cost was Rs 330.48 and Rs 348.86. Further, in the case of 100.00 kg capacity, total cost per day was observed to be Rs 31,565.74 and Rs 33,204.74 respectively for normal and fortified meat patties. The higher cost of fortified meat patties can be attributed to the increase in the formulation cost and is inevitable under formulation principals of food processing. It is justified by the improved functionality of the treated product. Verma (2015) made similar observations while working out cost of production of fibre-enriched pork loaves.

#### Returns

Gross returns (total revenue) were calculated by multiplying the volume of output produced with its selling price. The selling price was assumed to be ₹380.00 for normal meat patties and Rs 400.00 for fortified meat patties. From the value of gross returns, the total cost of production (total fixed costs + total variable costs) was subtracted to arrive at an estimate of net profit/net returns (Table 6). For 20.00 kg capacity plant, the net returns per day were ₹566.76 and ₹593.74 respectively for normal and fortified meat patties. The break even output is the minimum number of units of finished product produced at

**Table 4: Variable cost of goat meat patties manufacturing**

Particulars	Rate	20.00 kg capacity				100.00 kg capacity			
		Control		T2		Control		T2	
		Quantity (kg)	Cost (₹)	Quantity (kg)	Cost (₹)	Quantity (kg)	Cost (₹)	Quantity (kg)	Cost (₹)
Raw material (kg)	₹per kg								
Goat meat	360.00	14.66	5277.60	14.46	5205.60	73.30	26388.00	72.30	26028.00
Fat	95.00	0.60	57.00	0.60	57.00	3.00	285.00	3.00	285.00
Chilled water	0.00	1.00	0.00	1.00	0.00	5.00	0.00	5.00	0.00
TSP	200.00	0.70	140.00	0.70	140.00	3.50	700.00	3.50	700.00
Spices	397.40	0.40	158.96	0.40	158.96	2.00	794.80	2.00	794.80
Salt	15.00	0.30	4.50	0.30	4.50	1.50	22.50	1.50	22.50
Refined wheat flour	30.00	0.70	21.00	0.70	21.00	3.50	105.00	3.50	105.00
Condiments	53.00	0.60	31.80	0.60	31.80	3.00	159.00	3.00	159.00
STPP	1960.00	0.04	78.40	0.04	78.40	0.20	392.00	0.20	392.00
Whole egg liquid	120.00	1.00	120.00	1.00	120.00	5.00	600.00	5.00	600.00
Algal DHA oil	2000.00	0.00	0.00	0.20	400.00	0.00	0.00	1.00	2000.00
Sodium nitrite	428.00	0.0024	1.03	0.0024	1.03	0.0120	5.14	0.0120	5.14
Electricity (kWh)	₹6.0 per kWh	16.09	96.54	16.09	96.54	41.84	251.04	41.84	251.04
Packaging material	₹0.5 per packet	78.00	39.00	77.00	38.50	389.00	194.50	387.00	193.50
Water	₹20 per day		20.00		20.00		20.00		20.00
Miscellaneous	₹per day		100.00		100.00		200.00		200.00
Labour	280/day	1.00	280.00	1.00	280.00	3.00	840.00	3.00	840.00
<b>TVC/day</b>			<b>6425.83</b>		<b>6753.33</b>		<b>30956.98</b>		<b>32595.98</b>

DHA = Docosahexaenoic acid; TSP = Textured soya protein; STPP = Sodium tetra poly phosphate; TVC = Total variable cost; Weights are in Kg; Costs are in rupees

Miscellaneous expenses include maintenance and repair of equipment and machines; unforeseen first aid for personnel, any other immediate requirements etc.

**Table 5: Total cost of goat meat patties manufacturing (₹)**

Particulars	20.00 kg capacity		100.00 kg capacity	
	Control	T2	Control	T2
TFC/day	396.13	396.13	608.76	608.76
TVC/day	6425.83	6753.33	30956.98	32595.98
<b>Total cost/day (1+2)</b>	<b>6821.96</b>	<b>7149.46</b>	<b>31565.74</b>	<b>33204.74</b>
<b>TVC/kg</b>	<b>330.48</b>	<b>348.86</b>	<b>318.42</b>	<b>336.77</b>

which the total revenue equals total cost. The break-even point in an activity is reached when costs and income are in balance. At this point, a company has no losses and no profit (Medina et al., 2015). The break even output was calculated at 8.00 kg and 7.75 kg for normal meat patties and fortified meat patties respectively. In both the cases, the breakeven quantity is lower than the actual level of production providing enough margins of safety, 11.44 kg (58.86 per cent) and 11.61 kg (59.98 per cent) respectively. The benefit cost ratio was observed to be 1.08 in each case which is more than one indicating that the business is profitable. At the level of 100.00 kg

**Table 6: Returns from goat meat patties manufacturing**

Particulars	20.00 kg capacity		100.00 kg capacity	
	Control	T2	Control	T2
Product yield per cent	97.22	96.79	97.22	96.79
Yield/day in kg	19.44	19.36	97.22	96.79
Sale price/kg	380.00	400.00	380.00	400.00
Gross returns/day (2×3)	7388.72	7743.20	36943.60	38716.00
Net returns/day	566.76	593.74	5377.86	5511.26
Net returns/kg	29.15	30.67	55.32	56.94
Break even output	8.00	7.75	9.89	9.63
Margin of safety	11.44	11.61	87.33	87.16
Per cent margin of safety	58.86	59.98	89.83	90.05
B:C ratio	1.08	1.08	1.17	1.17

B:C ratio = Benefit cost ratio

capacity, due to prevalence of economies of scale, the profitability was quite higher as compared to 20.00 kg capacity plant. The net returns per day were ₹5377.86 and ₹5511.26 respectively for normal and fortified meat

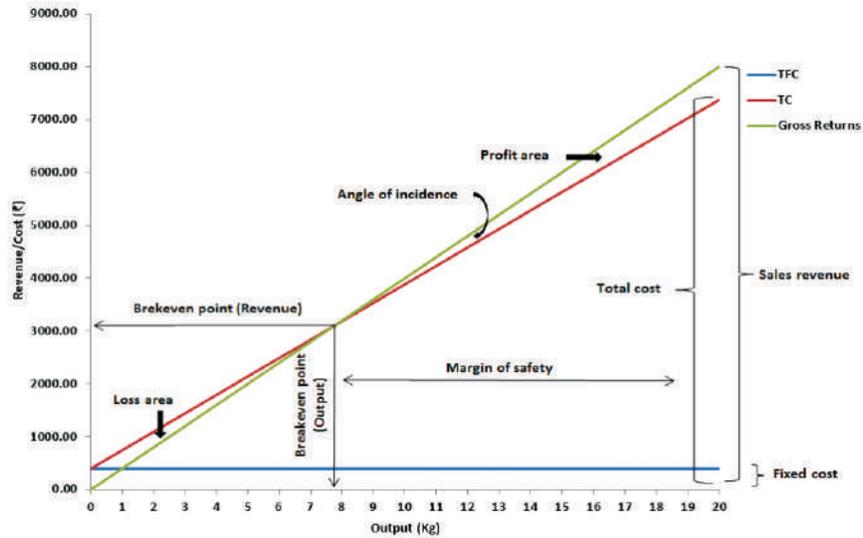


Figure 1: Breakeven chart for T2 (1.0 per cent algal DHA oil fortified goat meat patties) in 20.00 Kg per day production capacity project

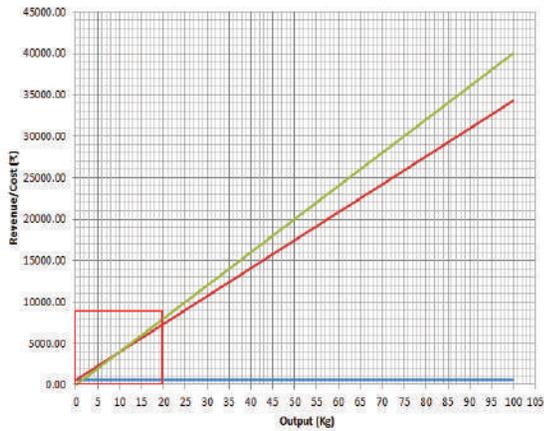


Figure 2a: Breakeven chart for T2 (1.0 per cent algal DHA oil fortified goat meat patties) in 100 Kg per day production capacity project.

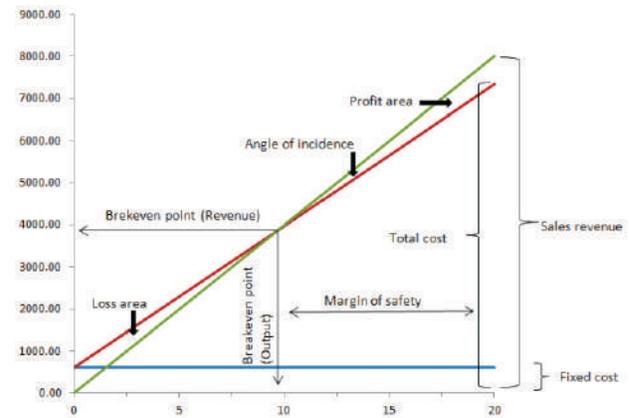


Figure 2b: Inset of figure 2a showing the events up to 20.00 Kg production level in 100.00 Kg production capacity project.

patties. The break even output was calculated at 9.89 kg and 9.63 kg for normal meat patties and fortified meat patties respectively. In both the cases, the breakeven quantity is much lower than the actual level of production providing enough margins of safety, 87.33 kg (89.33 per cent) and 87.16 kg (90.05 per cent) respectively. With the high margin of safety, we have low risk of business going into losses in the case of distortions in market prices. Similar results were found by Kumar *et al.* (2016) who reported that the break even output was calculated at 4.36 kg of paneer nuggets product which was much lower than the actual level of production of 20.00 kg providing enough margin of safety (78.20 per cent). The benefit cost ratio was observed to be 1.17 in each case which is more than one indicating that the business is profitable.

**CONCLUSIONS**

Fortification of goat meat patties with 1 per cent w/w ADO (Group T2) was estimated to generate highest overall acceptability by the consumers. At the same levels of benefit cost ratio, a functional product with higher consumer acceptability can be produced. At higher scale of production, the returns can be still increased due to prevalence of economies of scale at large scale. Hence, manufacture of functional goat meat patties can be taken up as a profitable start up business venture. Its adoption can help in providing regular income and employment to the farmers, especially small and marginal ones. In the period of much needed diversification of Punjab agriculture, such meat processing enterprises can be good option for ameliorating the economic distress in farming sector.

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**Appendix 1**  
**Cost of goat meat**

Item	Quantity	Amount (₹)
Live Goat kg (Average)	39.00	5600.00
Cost per kg of live weight	-	144.00 (Approx.)
Dressing per cent	50	-
Cost per kg of dressed meat	-	144 × 2 = 288
Meat bone ratio (Average)	3:1 (75 :25 )	-
Cost per kg of deboned meat	-	288 + 25% of 288 (72 = 360)
Meat produced per animal kg (Approx.)	14.66	

**Appendix 2**  
**Cost of spice mix and condiments used in formulation**

Name of Ingredients	Quantity (g)	Rate (per kg)	Approx. Cost
<b>a. Spices</b>			
Aniseed (Soanf)	100.00	120.00	12.00
Black pepper (Kalimirch)	100.00	725.00	72.50
Caraway seeds (Ajwain)	100.00	190.00	19.00
Cardamom dry (BadiElaichi)	50.00	1300.00	65.00
Cardamom (ChhotiElaichi)	20.00	850.00	17.00
Cinnamon (Dalchini)	50.00	170.00	08.50
Cloves (Laung)	50.00	1000.00	50.00
Coriander (Dhania)	150.00	140.00	21.00
Cumin seeds (Zeera)	150.00	200.00	30.00
Capsicum powder (MirchPowder)	80.00	150.00	12.00
Dry ginger powder (Soanth)	80.00	280.00	22.40
Mace (Javitri)	50.00	1000.00	50.00
Nutmeg (Jaifal)	20.00	900.00	18.00
<b>Total</b>	<b>1000.00</b>	<b>-</b>	<b>397.40</b>
<b>b. Condiments (3per cent) = 30 gm/kg</b>			
Garlic	200.00	100.00	20.00
Ginger	200.00	90.00	18.00
Onion	600.00	25.00	15.00
<b>Total</b>	<b>1000.00</b>	<b>-</b>	<b>53.00</b>



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## An Analytical Study of Rural Women Entrepreneurship to Enhance Income in Punjab

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### ABSTRACT

In India, women constitute around 48 per cent of the population but their participation in the economic activities is only 34 per cent. In rural India, the male work participation rate (WPR) is 53 per cent while that for female is only 30 per cent indicating that female workforce remains unutilized. In rural Punjab the female WPR was only 18.7 per cent in 2001 which further declined to 13.9 per cent during 2011 (the lowest in the country). An economy can move on to higher levels of growth through planned development by developing human resources to their brimming utilization. Women entrepreneurship has been recognized during the last decade as an important untapped source of economic growth. A total of one hundred and five respondents were selected for the study who had got trainings from KVK, Moga. The sample consisted of rural farm women/girls. Both primary as well as secondary data was used. There was a significant increase in the income of the respondents after entering the enterprise. Decrease in the value of Gini ratio from 0.63 to 0.36 shows that the income inequality between the entrepreneurs has increased after entering the enterprise. It was observed lack of finance to carry on business was mentioned as the major problem by the respondents (73.06 per cent) followed by other factors of marketing (67.11 per cent), social barriers (56.91 per cent), hesitation due to lack of risk bearing ability, an ability to make decisions independently, illiteracy (31.69 per cent) and forgetfulness (30.31 per cent). It is very true that rural entrepreneurship cannot be developed without proper training. Therefore, it is necessary to provide more training to rural women to enhance their entrepreneurial skill giving a path of success to rural women through Government institutes like KVKs. They need capacity building and training in functional areas such as finance, literacy skills, marketing, production and managerial skills. Entrepreneur network must be encouraged. Therefore government subsidies and credit facilities can help them for ball rolling of the new enterprises. Special credit cum debt account for the rural women can be started in local banks so that women can get better benefit of the various subsidies. There is a need for early dissemination of entrepreneurship education in the schools for timely exploration of entrepreneurial capabilities. Encouragement and assistance should be provided to rural entrepreneurs for setting up marketing co-operatives, and Self Help Groups to adopt collective approach.

### Keywords

Entrepreneurship, Garrett's ranking techniques, Gini co-efficient, income, rural women entrepreneur

### JEL Codes

C65, C81, O15

### INTRODUCTION

There are around seven lakh villages in India and about 69 per cent of our population live in villages (Census of India, 2011). Men and women both are two wheels of society and contribution of both is very essential for building a healthy nation. In India, women constitute around 48 percent of the population but their participation in the economic activities is only 34 per cent. In India, most of the women have been engaged in the household or agricultural activities, but their work could

not get recognition in the society and they were hardly involved in any commercial activity (Kumar & Gill, 2006). In rural India, the male work participation rate (WPR) is 53 per cent while that for female is only 30 per cent indicating that female workforce remains unutilized. Rural woman constitutes the family, which leads to society and Nation. Social and economic development of women is necessary for overall economic development of any society or a country. Entrepreneurship development among rural women also helps to enhance their personal

capabilities and increase decision making status in the family and society as a whole (Sharma *et al.*, 2012). The Planning commission as well as the Indian government recognizes the need for women to be part of the mainstream of economic development.

Economic growth and development of the country is determined by human, physical and financial resources. As far as rural development through rural entrepreneurs concerned it will stand as vehicle to improve quality of life of rural people, economic empowerment and sustainable development (Raju & Bhuvaneswari, 2014). The economic development of a nation is sparked largely by its enterprising spirit. The entrepreneur is responsible for not only earning his/her own livelihood but also for creating avenues of employment for others and contributing to the gross national product. An economy can move on to higher levels of growth through planned development by developing human resources to their brimming utilization. Women entrepreneurship has been recognized during the last decade as an important untapped source of economic growth. Even as women are receiving education, they face the prospect of unemployment. In this background, self employment is regarded as a cure to generate income. In present scenario the percentage of unemployment among educated and qualified women is increasing in rural areas, it is necessary to promote rural entrepreneurship as it will create more opportunities for rural people (Parveen, 2014). Women entrepreneurship is seen as an effective strategy to solve the problems of rural and urban poverty. Punjab state has the lowest female work force participation rate (13.9 per cent) in the country (Anonymous, 2012). In rural Punjab the female WPR was only 18.7 per cent in 2001 which further declined to 13.9 per cent during 2011. In the above backdrop, the present study was carried out with the following objectives:

- a. to identify the different constraints faced by rural women in acquiring/adopting new technology,
- b. to analyze monthly household income of the respondents before and after entering the enterprise, and
- c. to study various factors affecting entrepreneurial behaviour of women entrepreneurs while going ahead for entrepreneurial development and give possible suggestions.

#### METHODOLOGY

A total of one hundred and five respondents were selected for the study. To study the constraints in acquiring the trainings, 35 respondents were selected randomly who came across personnel from Krishi Vigyan Kendra (KVK), Moga during on or off campus trainings. Another 35 respondents were chosen who had acquired training during time period 2013-16 from KVK, Moga and further to study the constraints in entrepreneurship development, 35 respondents were chosen who had adopted the new technology acquired during trainings. The sample consisted of rural farm women/girls. Both

primary as well as secondary data (Anonymous, 2012-2016) was used to fulfill the desired objectives. The primary data was collected using pre-structured schedule. The gathered data was further processed, tabulated, classified and analysed using statistical tools like averages, percentages, t-test, Gini coefficient, and Garrett's ranking technique etc.

#### Gini Ratio

Gini co-efficient of concentration ratio was used to measure the extent of inequalities in the distribution of income in the households of entrepreneurs before and after entering the enterprise in the case of those engaged in different activities in the study area. The range of Gini ratio would be from 0 to 1. Gini ratio of 0 would mean that every individual would reserve exactly that same income i.e., perfect equality in distribution. Gini ratio of one mean that an individual would reserve the different income i.e., perfect inequality in income. Gini ratio was calculated by using the formula.

$$G = 1 - \frac{\sum_{k=1}^N (P_k - P_{k-1})(Q_k + Q_{k-1})}{10,000}$$

Where,

G = Gini coefficient of concentration

$P_k$  = Cumulative per cent of frequency of entrepreneurs

$Q_k$  = Cumulative per cent of income

N = Number of classes used in the analysis

#### Garrett's Ranking Technique

Garrett's ranking technique was used to rank the constraints faced by the respondents during adoption of an enterprise. As per this method, respondents were asked to assign the rank for all ten factors and the outcomes of such ranking have been converted into score value with the help of the following formula:

$$\text{Percent position} = 100 (R_{ij} - 0.5) / N_j$$

Where  $R_{ij}$  = Rank given for the  $j^{\text{th}}$  variable by  $j^{\text{th}}$  respondents

$N_j$  = Number of variables ranked by  $j^{\text{th}}$  respondents

With the help of Garrett's Table, the percent position estimated is converted into scores. Then for each factor, the scores of each individual are added and then total value of scores and mean values of score was calculated.

#### RESULTS AND DISCUSSION

Analysis of data relating to WPR indicated that there has been considerable decline in female work participation during the time period 2001-11 in all the districts as well as in the Punjab state (Table 1). During the decade gender gap in WPR has widened. The female work participation at state level declined from 18.7 per cent to 13.9 per cent while WPR for males declined only slightly from 55.2 per cent to 54.1 per cent. On the other hand in Moga district, the WPR of males increased from 54.3 per cent to 55.6 per cent while female WPR declined from 24.2 per cent to 14.2 per cent leading to a wide gender gap of 41.4.

Further, it was observed that difference between male

Table 1: Work participation rate in Punjab

District	(Per cent)					
	Male		Female		Gender gap	
	2011	2001	2011	2001	2011	2001
Gurdaspur	52.5	51.9	12.1	12.7	40.4	39.2
Pathankot	52.8	NA	8.2	NA	44.5	0.0
Amritsar	55.8	53.2	15.6	16.3	40.2	36.9
Tarnan	53.2	NA	12.6	NA	40.6	0.0
Kapurthala	55.3	53.4	12.5	14.1	42.8	39.3
Jalandhar	55.8	54.1	12.9	12.3	43.0	41.8
SBS Nagar	54.3	55.6	11.4	33.0	42.9	22.6
Hoshiarpur	51.0	51.0	11.2	17.3	39.8	33.7
Rupnagar	52.3	52.8	14.3	23.8	38.0	29.0
SAS Nagar	53.5	NA	15.6	NA	37.9	0.0
Ludhiana	56.4	55.9	14.2	15.7	42.2	40.2
Ferozpur	55.6	53.6	15.8	18.5	39.8	35.1
Fazilka	55.8	NA	17.7	NA	38.1	0.0
Faridkot	56.6	59.5	12.6	23.0	44.1	36.5
Sri Muktsar Sahib	57.3	55.2	14.7	22.3	42.6	32.9
Moga	55.6	54.3	14.2	24.2	41.4	30.1
Bathinda	58.3	55.4	18.1	27.0	40.1	28.4
Mansa	56.5	54.4	27.1	25.1	29.4	29.3
Sangrur	55.3	54.9	10.8	24.1	44.5	30.8
Barnala	56.1	NA	11.2	NA	44.9	0.0
Patiala	54.8	54.1	12.4	17.6	42.4	36.5
Fatehgarh Sahib	57.0	55.1	11.5	18.3	45.5	36.8
Punjab	55.2	54.1	13.9	18.7	41.2	35.4
<b>2011</b>		<b>Rural</b>			<b>Urban</b>	
	<b>Male</b>	<b>Female</b>	<b>Gender gap</b>	<b>Male</b>	<b>Female</b>	<b>Gender gap</b>
Moga	55.4	13.7	41.7	56.1	16.0	40.1
Punjab	54.9	14.3	40.6	55.5	13.2	42.3
India	53.0	30.0	23.0	53.8	15.4	38.4

Source: Census of India, 2011

and female WPR is larger in urban areas than that of rural areas not only at state level but at the national level also. In spite of this, a significant difference is found between rural and urban female work participation rate both at the state and national level. Rural-urban analysis revealed a significant difference between rural and urban female work participation rates in Moga also though higher gender gap was observed for rural Moga.

The socio-economic characteristics of respondents were analyzed and it was observed that about 91 per cent of the respondents resided in rural area while about 9 per cent belonged to urban area (Table 2).

About 70 per cent of respondents belonged to scheduled caste group. The number of middle age respondents i.e. in age group of 30-45 years constituted the maximum (55.24 per cent) share of the respondents. It is believed that in this particular age group the risk taking ability of an individual is highest. The findings are in agreement with results revealed by Kumar and Gill(2006). Regarding the marital status about 66 per cent were married. It was also observed that 31.43 per cent of

the respondents had primary education, about 27 per cent had matriculated, about 27 per cent had passed 10+2 and only about 7 per cent had pursued degrees. Further, 18 per cent remained totally illiterate. Majority of the respondents (55.24 per cent) belonged to joint families. Our sample consisted of about 8 per cent respondents opting for agro processing entrepreneurship while those adopting fabric painting, tie and dye, soft toy making, garment construction, detergent and soap making, kitchen gardening and food preservation were about 3, 3, 5, 7, 3, 3 and 3 per cent respectively. About 73 per cent of the respondents were from income group ₹1.5 to ₹2.5 lakh.

While asked about problems faced by the selected respondents in getting trainings from KVK, Moga, the major constraint mentioned was domestic obligation (60 per cent) while another 57 per cent mentioned long distance to be travelled as major issue (Table 3). Another 54 per cent were not willing to face questions arising in the society and about 51 per cent mentioned illiteracy to be the main hindrance.

After acquiring the training, the women/girls faced

**Table 2: Socio personal profile of the respondents**

Characteristics	(N = 105)	
	No. of respondents	Per cent
<b>Area of residence</b>		
Rural	96	91.43
Urban	9	8.57
<b>Age (years)</b>		
Young (15-30)	33	31.43
Middle (30-45)	58	55.24
Old (45-60)	14	13.33
<b>Caste</b>		
General	73	69.52
Scheduled caste	32	30.48
<b>Marital status</b>		
Married	69	65.71
Unmarried	36	34.29
<b>Educational level</b>		
Illiterate	19	18.10
Primary	33	31.43
Upto Matric	28	26.67
Upto 10+2	18	17.14
Graduate	7	6.67
<b>Type of family</b>		
Joint	58	55.24
Nuclear	47	44.76
<b>Type of enterprise adopted</b>		
Agro processing	8	7.62
Fabric painting	3	2.86
Tie and dye	3	2.86
Soft toy making	5	4.76
Garment construction	7	6.67
Detergent and soap making	3	2.86
Kitchen gardening	3	2.86
Food preservation	3	2.86
<b>Size of family</b>		
Nuclear	46	43.81
Joint	59	56.19
<b>Family income</b>		
Upto 1.5 lakh	32	30.48
1.5 lakh to 2.5 lakh	73	69.52

some problems in adopting the learnt technology in their day to day life as about 94 per cent were hesitant or lacked motivation. About 71 per cent had mobility constraints; about 66 per cent mentioned family ties to be major problem and another 37 per cent each faced illiteracy and lack of money.

At the stage of opting an enterprise maximum respondents faced problem of finance/ start up capital (about 74 per cent), another 54 per cent were not ready to face tough competition from existing ones or males, about 51 per cent failed to find markets for their products. About 67 per cent were unable to move long distances to buy/sell products. 53 per cent were having low need of

achievement and they were getting no motivation from their family. About 47 per cent had domestic obligations also. Goyal & Parkash (2011) also cited motherhood as one of the major reasons for the delayed entry into entrepreneurial careers.

The perusal of Table 4 reveals the monthly income of the respondents before and after entering the enterprise. Before entering the enterprise 33 per cent of the respondents had monthly family income of less than ₹10,000 whereas after entering the enterprise their number declined to about 21 per cent. Further, the number of respondents in income category of ₹10,000 to ₹15,000 declined from 21 per cent to about 15 per cent. On the other hand, 26, 14 and 7 per cent of the respondents had monthly family income between ₹15000-₹20000, ₹20000-₹25000 and above ₹25000 respectively before entering the enterprise. But after entering the enterprise it was 33, 18 and 13 per cent respectively indicating that that after entering the enterprise the respondent's monthly family income has shown a substantial increase. In order to study the impact of enterprise on income of the sample respondents paired t-test was used. Mean of differences came out to be -3198.57. The t-value (14.87) was significant statistically, indicating that there was a significant increase in the income of the respondents after entering the enterprise.

Gini co-efficient of concentration ratio was used to measure the extent of inequalities in the distribution of income in the households of entrepreneurs before and after entering the enterprise in the case of those engaged in different activities in the study area. The estimated values of Gini ratio before and after entering the enterprise clearly indicated that there is no perfect equality among the entrepreneurs household income. But decrease in the value of Gini ratio from 0.63 to 0.36 shows that the income inequality between the entrepreneurs has increased after entering the enterprise (Table 4).

To study the intensity of problems faced by the women entrepreneurs in running their enterprises the ranking of problems faced was done (Table 5). It was observed lack of finance to carry on business was mentioned as the major problem as economically they themselves are not self-dependent. Next major issue was to find market to sell the finished product followed by difficulty in facing society, male dominance patriarchal male dominant society, non-allowance by family to move out of village alone, hesitation due to lack of risk bearing ability, inability to make decisions independently, illiteracy and forgetfulness due to diversion of mind in different sides, that is, family, children, business etc. Rural women in Indian Society have got restricted mobility. Their carrier is limited in four walls of kitchen. The women confined themselves to three KS-Kitchen, kids & knitting.

## CONCLUSIONS

The rural women by all means can be very effective agents of change for better homes, better society and ultimately for robust economy in the present global

**Table 3: Constraints faced by rural women/girls**

Characteristics	(N = 105, n <sub>1</sub> , n <sub>2</sub> , n <sub>3</sub> = 35)		
	Acquiring training (Per cent)	Adoption of new technology (Per cent)	Entrepreneurship development (Per cent)
Long distance of training centre (KVK)	57.14	0	0
Ignorance	25.71	0	0
Domestic obligations	60.00	65.71	47.14
Hesitation/lack of motivation/low need of achievement	0	94.29	53.35
Mobility constraints	0	71.43	67.14
Social attitudes	54.29	37.14	57.43
High cost of production/lack of finance/raising start up capital	0	37.14	74.29
Illiteracy	51.43	37.14	31.43
Low risk bearing ability	0	0	28.57
Tough Competition	0	0	54.29
Marketing problem	0	0	51.43

**Table 4: Monthly household income of the selected respondents**

Monthly household income (₹)	Per cent of respondents	
	Before entering the enterprise	After entering the enterprise
Below 10000	33	21
10000–15000	21	15
15000–20000	26	33
20000–25000	14	18
Above 25000	7	13
Mean of differences	-3198.57	
Variance of differences	1620218.49	
Standard deviation of differences	1272.88	
t value	-14.87**	
Degree of freedom	34	
Gini ratio	0.63	0.36

\*\*Significant at 5 per cent level

scenario. With the growth of population, the women labour force has increased. But the women work participation rate in the country as a whole has been significantly lower than that of men. The main reason is their unequal status in the male dominated society. Our society and culture never permit women to seek and obtain adequate education, outside employment, security and independent status. Women need encouragement and support from the family members, government, society, male counter parts etc., and with the right assistance, they can join the main stream of national economy and thereby

**Table 5: Factors affecting entrepreneurial behaviour of selected respondents**

Problems	Average score	Garett ranks
Financial problems	73.06	1
Marketing of final product	67.11	2
Social factors	58.91	3
Male dominance	56.57	4
Girls not allowed to go out	52.63	5
Hesitant	49.43	6
Domestic obligations	45.29	7
Problem in decision making	32.63	8
Illiteracy	31.69	9
Forgetfulness	30.31	10

contribute to the economic development. Lack of education is one of the biggest obstacles for rural women who want to start an enterprise. Due to lack of proper education, women entrepreneurs remain in dark about the development of new technology, new methods of production, marketing and other governmental support which can encourage them to flourish. It is very true that rural entrepreneurship cannot be developed without proper training. Therefore, it is necessary to provide more training to rural women to enhance their entrepreneurial skill giving a path of success to rural women through Government institutes like KVKs. Government should draw up a plan so that the Indian women entrepreneurs can work more on empowerment through training and capacity building programs. Rural women are not so aware and literate as to handle all the legal and other

formalities involving in loan taking and establishing an Industrial Unit. The women access to the income in the family is also a constraint for proper utilization of women skills. Due to paucity of funds many trained workers were unable to utilize their skills properly. Therefore government subsidies and credit facilities can help them for ball rolling of the new enterprises. Therefore special credit cum debt account for the rural women can be started in local banks so that women can get better benefit of the various subsidies. Financial institutions and banks can provide finance to the entrepreneurs through easy finance with less complicated procedure. More over formation and strengthening of rural women

There is a need for early dissemination of entrepreneurship education in the schools for timely exploration of entrepreneurial capabilities. The women also lack confidence in their ability to run the entrepreneurship. They need capacity building and training in functional areas such as finance, literacy skills, marketing, production and managerial skills. Entrepreneur network must be encouraged. Encouragement and assistance should be provided to rural entrepreneurs for setting up marketing co-operatives and Self Help Groups to adopt collective system approach.

It is worthwhile to conclude by quoting the words of

Pandit Jawaharlal Nehru.

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## Export Status of Processed Agricultural Food Products in India

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### ABSTRACT

Food processing industry in India is a sunrise sector and has gained prominence over the recent years. It is one of the largest industries and ranks fifth in terms of production, consumption, export and expected growth. It has tremendous export potential, as processed agricultural food items registered 9.61 per cent and 21.56 per cent growth in export quantity and value, during the period of 10 years. The share of processed agri. food items in total export and agri. export was 1.1 per cent and 24 per cent. India's export of Processed Agricultural Food products was ₹26067.64 crores in the year 2015-16. There is a need to cover this untapped potential of food processing sector through export promotion or incentives and by providing better infrastructure like- storage and processing facilities to reduce wastages as India is second largest producer of fruits and vegetables.

### Keywords

Agricultural, agrifood, export, food processing, production, storage

### JEL Codes

F10, E23, Q10, Q17

### INTRODUCTION

The Indian food industry is poised for huge growth, increasing its contribution to world food trade every year. In India, the food sector has emerged as a high-growth and high-profit sector due to its immense potential for value addition, particularly within the food processing industry. The Indian food processing industry accounts for 32 per cent of the country's total food market, one of the largest industries in India and is ranked fifth in terms of production, consumption, export and expected growth. It contributes around 14 per cent of manufacturing Gross Domestic Product (GDP), 13 per cent of India's exports and six per cent of total industrial investment (Ministry of Food Processing Industries (MoFPI)).

India's food processing sector covers diversified varieties of products, which are listed under the Table 1. India's export of Processed Agricultural Food products was Rs 26067.64 crores in the year 2015-16. The Indian food processing industry is basically export oriented. India's geographical situation gives it the unique advantage of connectivity to Europe, Middle East, Japan, Singapore, Thailand, Malaysia and Korea ([www.apeda.gov.in](http://www.apeda.gov.in)). India accounts only 1.7 per cent of world trade in food processing sector. Though India has a good raw material base of the food processing industry,

the country has been unable to tap its potential (Athukorala & Jayasuriya, 2003). Only 12 per cent of food *i.e.* 2.2 per cent of the fruits and vegetables, 35 per cent of milk, 20 per cent of meat, 6 per cent of poultry and 2 per cent of marine products in India are processed, a figure that is much lower when compared to countries like Malaysia (83 per cent), Philippines (78 per cent), China (23 per cent) and some other countries (Saraswati, 2014).

Not only in the increase of foreign exchange earnings, processed food export had multidimensional effect in the economy. It can be a viable instrument to sustain and enhance social welfare in developing countries (Mehta & George, 2003). With the growing demand of processed food in the global market, Government of India is paying attention to export oriented food processing industries by giving export incentives (Majumdar, 2016). Keeping this in view, present paper has been written on food processing industry from the perspective of exports. It studies the overall scenario of export and import quantity as well as value, growth rates of export value and quantity and major export destinations of processed agricultural food items.

### METHODOLOGY

The study utilized the secondary data gathered from the various publications and web sites of Agricultural and Processed Food Products Export Development Authority

(APEDA), Ministry of Food Processing Industries (MOFPI), Department of Industrial Policy and Promotion (DIPP), DGCIS and other various sources. The data gathered pertained to export quantity and export value of processed agri. food products for 10 years that is, from 2006-07 to 2015-16 and import quantity and value for 7 years from 2008-09 to 2014-15. Percentage was computed wherever necessary for the above variables.

The data were compiled and analyzed using standard statistical tools. The CGR (Compound Growth Rate) was calculated by using the following methods.

The CGR was calculated by fitting the exponential function given below:

$$Y = a b^t \dots\dots\dots (1)$$

Where, Y= Export quantity/value/import quantity/value

a = constant

b= regression co-efficient

t= time variable

Thus, natural log on both the sides of eq (1) was taken to convert it in to linear form.

$$\log Y = \log a + t \log b \dots\dots\dots (2)$$

and, CGR (%) was work out using following formula:

$$\text{CGR} (\%) = (\text{antilog of } b-1) * 100 \dots\dots\dots (3)$$

The percentage Growth was calculated by using the following formula:

$$\text{Growth} (\%) = C-P/P * 100 \dots\dots\dots (4)$$

C = Current year (2015-16)

P= Previous year (2006-07)

## RESULTS AND DISCUSSION

The Indian processed food industry has shown a tremendous potential for exports. The status of export in India is given in Table 2.

According to the Table 2, that during 2005-06 the total export from the country was worth ₹456417.8 crore which included ₹5475.97 crore of processed agri. food products. This was 1.2 per cent of the total exports. During the study period (2005-06 to 2014-15), total export increased from ₹456417.8 crores to ₹2846533 crores with the compound growth of 22 per cent, total agricultural export increased from ₹18679 crores to ₹131333 crores with the growth of 25 per cent and total processed agri. food export increased from ₹5475 crores to ₹31563 crores with the compound growth of 24 per cent. The percentage of processed agri. food to total export is only about 1.1 and percentage of processed agri. food to total agricultural export was 24 during the year 2014-15, which shows untapped potential and tremendous scope of export in India. As India is the second largest producer of fruits and vegetables after China, which shows wide capacities in terms of further processing of products. It is increasingly becoming evident that only a dynamic food processing sector can lead to increasing farm gate price and thus increase the income levels of farmers, reduce wastage and increase employment opportunities.

**Table 1: Segmentation of different sector in food processing industry**

Sectors	Products
Diary	Whole milk powder, skimmed milk powder, condensed milk, ice cream, butter and ghee, cheese.
Fruits and vegetables	Beverages, juices, concentrates, pulp, slices, frozen and dehydrated products, potato wafers/ chips, etc.
Grains and cereals	Flour, bakeries, starch glucose, corn flakes, malted foods, grain based alcohol.
Fisheries	Frozen and canned products mainly in fresh form.
Meat and poultry	Frozen and packed mainly in fresh form, egg powder.
Consumer foods	Snack food, namkeens, biscuits, ready to eat food, alcoholic and non-alcoholic beverages.

Source: Anonymous (2004)

**Table 2: Status of export in India**

Year	(Value in ₹crores)				
	Indian total export	Indian agri-export	Indian processed agri. food export	Per cent of processed agri. food to total export	Per cent of processed agri. food to agri-export
2005-06	456417.8	18679.31	5475.97	1.20	29.32
2006-07	571779.2	21156.3	6095.64	1.07	28.81
2007-08	655863.5	29581.88	6765.64	1.03	22.87
2008-09	840755.1	35474.62	8949.57	1.06	25.23
2009-10	845533.59	35350.95	8662.92	1.02	24.51
2010-11	1142921.72	42437.46	12250.19	1.07	28.87
2011-12	1465959.19	83485.29	32174.80	2.20	38.54
2012-13	2429015	118254.77	38150.86	1.57	32.26
2013-14	2818695	136920.07	31552.00	1.12	23.04
2014-15	2846533	131333.46	31563.42	1.11	24.03
<b>CGR per cent</b>	<b>21.91**</b>	<b>24.42**</b>	<b>24.31**</b>		

Table 3 gives picture of export and import of processed agri. food products in India. During the period of 7 years (2008–09 to 2014–15), the export quantity registered growth of 7.67 per cent and import quantity registered a little high growth rate 9.22 per cent. While, the growth in export value and import value was 16.97 per cent and 20.19 per cent, respectively. The import quantity was higher for all the years as compared to export quantity but in case of value, export value of processed products was higher as compared to import value, which further indicated that good quality products are heavily demanded worldwide. Processed food products has tremendous export potential, enabling the farmers to add value to his produce both in terms of quantity and quality so that he can meet the requirements and standards of market at all stages of value chain.

The processed agri. food export from India was Rs 26067.64 crores in the year 2015–16. The export trends of the selected processed food items and export destinations are discussed below:

#### Dried & Preserved Vegetables

India is the major producer and also a prominent exporter of dried and preserved vegetables like—preserved onions, cucumber & gherkins, mushrooms, truffles, green pepper, dried truffles, asparagus dried, garlic powder, potatoes dried, grams *etc.* to the world. The export of dried & preserved vegetables from India has increased from ₹218 crores (29761.4 MT) in 2006–07 to ₹914 crores (66189.62 MT) in 2015–16. During the period of 10 years, 122 per cent growth was observed in the export quantity (Table 4). The important importers of Indian dried & preserved vegetables are Germany, United Kingdom, United States, Russia and Belgium (Table 5).

#### Mango Pulp

India is the largest mango producer and major exporter of mango pulp in the world. Mango pulp export from India has increased from ₹505.83 crores (156835.5 MT) in 2006–07 to ₹796.17 crores (128866 MT) in 2015–16. The export growth in quantity of mango pulp was negative (Table 4). Saudi Arabia, Netherland, Yemen Republic, Kuwait and UAE are the major export markets of Indian mango pulp (Table 5).

#### Other Processed Fruits and Vegetables

Processed fruits and vegetables includes apple juice, asparagus, beans shelled, cashew nuts/ roasted and salted, cherries, chips fried, dried apples, dried apricots, fruits & nuts, uncooked or cooked, grape juice, grapefruit juice, jam jellies of apple, jam jellies of other fruits, mango juice, lemon juice, olives, pineapple juice, sweet corn, tomato juice, tomato prepared of preserved *etc.* India's export of other processed fruits and vegetables has increased from Rs 662.12 crores (172909.7 MT) in 2006–07 to ₹2900 crores (320732.6 MT) in 2015–16 (Table-4). The growth per cent in export quantity was 85 per cent as compared to the year 2006–07. The processed fruits and vegetables industry in India is one of the largest in term of production and consumption. Major export destinations are United States, Netherland, Saudi Arabia, United Kingdom and UAE (Table 5).

#### Pulses

Though, India imports large quantities of pulses, it also exports some processed pulses. India's export of pulses has increased from ₹790 crores (255084.5 MT) in 2006–07 to ₹1603 crores (251644.3 MT) in 2015–16. The growth per cent in export quantity was negative (–1.35 per cent) as compared to previous year (2006–07) (Table 4). Indian major pulses importing countries are Pakistan, Algeria, Sri Lanka, Turkey and UAE (Table 5).

#### Groundnuts

India is one of the major exporting country of groundnuts after China and its export has increased remarkable from ₹798.46 crores (251428.7 MT) in 2006–07 to ₹4046 crores (537888.3 MT) in 2015–16 with growth percentage of 114 per cent (Table-4). The major markets for Indian groundnuts are Indonesia, Malaysia, Thailand, Philippines and Pakistan.

#### Guar Gum

India is the single largest producer and major exporter of Guar in the world. It exports various forms of guar products to a large number of countries. India's export of guar gum was ₹1125 crores with the quantity of 189304 MT in 2006–07 and increased to ₹3234 crores and 325251 MT in value and tonnes, respectively in 2015–16. The growth percentage was 72 per cent as compared to the

**Table 3: India's export and import of processed agricultural food products**

Year	Export		Import	
	Quantity (MT)	Value (₹crores)	Quantity (MT)	Value (₹crores)
2008–09	2325147.13	8949.57	2893350.82	8559.23
2009–10	1960585.35	8662.92	4398316.58	13492.79
2010–11	2401230.36	12250.19	3327474.26	11020.29
2011–12	3603545.13	32174.8	3922632.62	13666.49
2012–13	3259661.85	38150.86	4405062.25	18303.86
2013–14	3866652.68	31552	3661082.77	17004.22
2014–15	4019311.12	31563.42	4591130.77	21842.9
CGR (Per cent)	7.67*	16.97**	9.22**	20.19**

\* and \*\* significant at 5 and 1 per cent level

year 2006-07 (Table 4). The high demand of Indian guar gum is observed in USA, China, Germany, Russia and Canada (Table 5).

**Jaggery and Confectionary**

As the major producer of Jaggery, India has recognized as one of the leading trader and exporter of Jaggery to the world. Bakery industry is the largest sector of food processing industry. India's export of Jaggery &

**Table 4: Exports of Indian processed agricultural foods**

Processed food item	(₹ crores)				
	2006-07		2015-16		Growth (Per
	Quantity (MT)	Value	Quantity (MT)	Value	
Dried and preserved vegetables	29761.4	218.51	66189.62	914.21	122.40
Mango pulp	156835.5	505.83	128866	796.17	-17.83
Other processed fruits and vegetables	172909.7	662.12	320732.6	2900.33	85.49
Pulses	255084.5	789.99	251644.3	1603.22	-1.35
Groundnuts	251428.7	798.46	537888.3	4046.05	113.93
Guar gum	189304.4	1125.79	325250.7	3233.87	71.81
Jaggery& confectionary	77994.06	223.82	292212	1289.26	274.66
Cocoa products	3412.21	40.12	32633.62	1266.99	856.38
Cereal preparations	112650.4	601.54	314644.6	3341.31	179.31
Alcoholic beverages	48631.82	216.7	239127.5	2005.13	391.71
Miscellaneous preparations	67895.38	305.9	354905.2	2593.49	422.72
Cucumber & Gherkin	234725	502.63	202926.9	999.17	-13.55
Milled products	76167.57	104.23	416079.4	1078.44	446.27
Total	1676800	6095.64	3483101	26067.64	107.72

**Table 5: Importers (top five) of the Indian processed agricultural food products, 2015-16**

Product	Top 5 countries				
Dried and preserved vegetables	Germany (16.15)	UK (10.72)	USA (8.83)	Russia (5.79)	Belgium (5.27)
Mango pulp	Saudi Arabia (27.88)	Netherland (10.93)	Yemen Republic (6.88)	Kuwait (6.46)	UAE (5.89)
Other processed fruits and vegetable	USA (15.31)	Netherland (11.27)	Saudi Arabia (10.31)	UK (9.94)	UAE (8.12)
Pulses	Pakistan (25.70)	Algeria (14.32)	Sri Lanka (12.10)	Turkey (7.39)	UAE (5.34)
Groundnuts	Indonesia (32.79)	Malaysia (14.33)	Thailand (12.03)	Philippines (9.84)	Pakistan (4.70)
Guar gum	USA (51.57)	China (9.19)	Germany (6.00)	Russia (5.27)	Canada (3.69)
Jaggery and confectionary	Nigeria (9.67)	Nepal (8.33)	UAE (6.02)	Kenya (5.92)	Sudan (5.50)
Cocoa products	USA (19.05)	Singapore (12.81)	UAE (7.74)	Korea (7.61)	China (5.93)
Cereal preparations	USA (17.28)	UAE (7.15)	Bangladesh (6.94)	UK (6.93)	Nepal (6.47)
Alcoholic beverages	UAE (25.24)	Nigeria (13.06)	Ghana (8.90)	Singapore (8.42)	Netherland (3.97)
Miscellaneous preparations	USA (16.84)	UAE (8.88)	Nepal (6.69)	Indonesia (5.44)	Bangladesh (5.31)
Cucumber and gherkin	USA (24.49)	Russia (11.94)	Belgium (9.42)	France (7.68)	Spain (7.22)
Milled products	UAE (16.13)	USA (15.58)	Somaliya (11.39)	Oman (6.40)	Medagaskar (4.49)

Confectionary has increased from ₹224 crores in 2006-07 to ₹1267 crores in 2015-16. Growth percentage in export quantity was 275 per cent (Table 4). Nigeria, Nepal, UAE, Kenya and Sudan are the major importers from India.

#### Cocoa Products

Export of Cocoa products has increased from ₹40 crores in 2006-07 to ₹1267 crores in 2015-16. The growth percentage in export quantity was remarkable 856 per cent over the year 2006-07. Almost 10 times improvement in export quantity was observed during the period of 10 years (Table 4). The global destinations for Indian Cocoa Products are USA, Singapore, UAE, Korea and China (Table-5).

#### Cereal Preparations

India has increased its share in the international market. In terms of value it increased from ₹601 crores in 2006-07 to ₹3341 crores in 2015-16 (5 times increment). The growth percentage in export quantity during the period of 10 years was 179 per cent (Table-4). The major destinations for Indian cereal preparations are USA, UAE, Bangladesh, UK and Nepal (Table 5).

#### Alcoholic Beverages

India's export of alcoholic beverages was ₹217 crores (48632 MT) in 2006-07 and increased to ₹2005 crores (239127 MT) in 2015-16. Almost 5 times improvement in export value and quantity was observed during the period of 10 years (Table 4). UAE, Nigeria, Ghana, Singapore and Netherland are the major importers of alcoholic beverages from India (Table 5).

#### Miscellaneous Preparations

Miscellaneous Preparations products in Processed Food includes Dried Soups & baths & preparations, Soft Drink Concentrates, Ice cream & other edible ice, Sauces & ketchup, Pan Masala, Betel Nuts, Mineral waters, Malt, Custard powder, Lemonade *etc.* India's export of miscellaneous preparations has increased from ₹305.9 crores (67895.38 MT) in 2006-07 to ₹2593.49 crores (354905.2 MT) in 2015-16. The growth percentage during the study period in export quantity was 422.72 per cent (Table 4). The major destinations are USA, UAE, Nepal, Indonesia and Pakistan.

#### Cucumber and Gherkins (Processed & Preserved)

The export value has increased from ₹502.63 crores in 2006-07 to ₹999.17 crores in 2015-16. The growth per cent in export quantity was negative (13.55 per cent) over the previous year (2006-07) (Table 4). USA, Russia, Belgium, France and Spain are the major importers of Indian cucumber & Gherkins (Table 5).

#### Milled Products

India is exporting large quantity of these products to the world. The growth percentage in export quantity was 446 per cent over the previous year 2006-07. Almost 6 times improvement in export quantity and 10 times increment in export value were observed during the period of 10 years. The major destinations for Indian milled products are UAE, USA, Somaliya, Oman and Medagaskar.

### Growth Rates of Indian Processed Agricultural Food Export

The growth rate of the above mentioned selected processed agricultural food products are analyzed and presented in Table 6. From the table it can be concluded that total processed agricultural food products registered growth rate 9.61 per cent & 21.56 per cent (Both highly significant) in export quantity and value respectively, during the study period (2006-07 to 2015-16). The highest growth rate in export quantity was observed in the case of Milled Products (24.62 per cent) followed by Cocoa Products (23.54 per cent) and Alcoholic Beverages (23.28 per cent). However, in terms of the value of the exports, the highest growth rate was observed for Cocoa Products (39.58 per cent), Milled Products (31.17 per cent) and Guar Gum (27.75 per cent).

**Table 6: Growth rate of export of Indian processed agricultural foods**

Product	Growth rates (Per cent)	
	Quantity	Value
Dried and preserved vegetables	6.63*	17.92**
Mango pulp	-1.85	4.15*
Other processed fruits and vegetables	7.36**	17.73**
Pulses	5.01	12.96**
Groundnuts	11.09**	20.47**
Guar gum	11.79**	27.75**
Jaggery and confectionary	5.62	15.92**
Cocoa products	23.54**	39.58**
Cereal preparations	11.40**	20.23**
Alcoholic beverages	23.28**	27.23**
Miscellaneous preparations	19.35**	25.08**
Gherkin	-0.58	9.52**
Milled products	24.62**	31.17**
Total	9.61**	21.56**

\*\* and \*Significant at one and five per cent level

Both in terms of quantity and value, double digit and highly significant growth rate was observed in case of various processed products like—Groundnuts, Guar Gum, Cocoa Products, Cereal Preparations, Alcoholic Beverages, Miscellaneous Preparations and Milled Products. The negative growth rate (Non-significant) was observed in Mango Pulp and Gherkin in terms of export quantity.

The significant difference among these two growths (in quantity and value) also indicates rapid increase in the price among international market. During the study period, dried and preserved vegetables registered 6.63 per cent growth rate in export quantity and little high about 18 per cent growth in value. For Pulses the figures are 5 per cent and 13 per cent.

### CONCLUSIONS

Indian processed food sector has potential market in the foreign countries. It is one of the largest industries and

ranks fifth in terms of production, consumption, export and expected growth. The share of processed agricultural food products to total export and agricultural export was 1.2 per cent and 24 per cent respectively. It has tremendous export potential as the industry is growing with 9.61 per cent and 21.5 per cent CGR in export quantity and value during last 10 years, enabling the farmers to add value to his produce both in terms of quantity and quality. The highest growth rate in export quantity was observed in the case of Milled Products (24.62 per cent) followed by Cocoa Products (23.54 per cent) and Alcoholic Beverages (23.28 per cent). However, in terms of the value of the exports, the highest growth rate was observed for Cocoa Products (39.58 per cent), Milled Products (31.17 per cent) and Guar Gum (27.75 per cent).

#### **SUGGESTIONS**

To boost the growth, Increase the share of exports, the Government and the industry have to work in close unison. The industry needs to adopt the latest technologies to inject greater efficiency which could provide economies of scale and cost effectiveness. Government should pay more attention on the promotion

of export processing units.

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## Cost Analysis and Pilot Consumers Study of Omega 3 Enriched Fruit Yoghurt

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### ABSTRACT

Foods which provide well known health benefits to consumers are getting more importance in the market. Yoghurt is a famous fermented milk product produced with the help of yoghurt cultures. Dairy products like yoghurt can be logical vehicles for omega-3 fatty acids and fruits (iron rich) because they are widely consumed by all categories of population and also help in lowering the omega-6 to omega-3 fatty acid ratio. Cost of the product is an important competitive factor while launching the new functional dairy products in the market. The sale price of the fruit yoghurt in the present market condition is 120 per kg; cost of the developed functional fruit yoghurt was 102.7 per kg, a profit of 17.30 per kg could be obtained which is a good profit margin for the commercial viability and sustainability of the product. The break even output was calculated 35.01 kg of product which is lower than the actual level of production indicating the viability of this enterprise. The pilot study on consumer acceptance indicated that after understanding the health benefits of the yoghurt supplemented with omega 3 fatty acids and fruits, nearly 94 per cent of the respondents liked the developed product.

### Keywords

Breakeven point, fruit Yoghurt, fixed cost, pilot consumer study, variable cost

### JEL Codes

Q12, Q13

### INTRODUCTION

In India, about 10 per cent of total milk produced is converted into fermented milk products, and this sector is growing healthily at more than 20 per cent (Singh, 2011). Yoghurt is a popular fermented dairy product produced by the "yoghurt cultures", consisting of *Lactobacillus delbrueckii* subsp. *bulgaricus* and *Streptococcus salivarius* subsp. *thermophilus*. The stirred yoghurt is prepared by fermenting the heat treated and cooled milk in bulk and the final coagulum is "broken" by stirring before chilling and packing into individual package. The texture of the stirred yoghurt will be lesser firmness than the set yoghurt and somewhat like a very thick cream. Milk is a complex mixture of specific bioactive proteins, lipids, lactose, minerals. Fat consists of both saturated and unsaturated fatty acids. Milk fat is a poor source of omega 3 fatty acids. The omega 3 fatty acid content in milk fat is less than 0.5 per cent and this is mainly alpha -linolenic acid (Jensen *et al.*, 1991). Milk is a poor source of iron, containing 0.3 mg/kg of milk. In India, anaemia affects an

estimated 50 per cent of the population, particularly in women anaemia may become the underlying cause of maternal mortality and perinatal mortality. (Agarwal *et al.*, 2006). Keeping this fact in mind, the present study was also focused to provide functional yoghurt incorporated with iron rich fruits to improve haemoglobin levels in the body so as to prevent the iron deficiency in pregnant women and children. Some foods and beverages are fortified with omega-3 fatty acids to serve as vehicles to deliver these omega-3 fatty acids into the consumer's diets and aid in lowering the omega-6 to omega-3 fatty acid ratio. Currently, many products utilize marine-derived omega-3 fatty acids that may develop a fishy or metallic off-flavor due to the high susceptibility to lipid oxidation (Let *et al.*, 2005). In addition, many vegetarian and non-seafood consumers may be opposed to consuming these food products. A less explored alternative is the use of plant-derived omega-3 fatty acids in the formulation of novel functional food and beverage products. Flaxseed is the richest plant source of omega-3

fatty acids, as well as an excellent source of fiber and lignans. The increasing interest of consumers in disease prevention and the scientific evidence about the benefits of functional foods have stimulated the food industry to invest in the development of healthier products.

Punjab is one of the top five milk producing states in the country. As per recent official data (2013–14) from NDDDB, Punjab's per capita milk availability at 980 gm is much higher than the national average of 307 gm. In Punjab state, the farmer's income is declining from agricultural farming due to lesser yields of crops, this may be deterioration of soil quality and declining level of water table. This conditions forces the Punjab farmers to move towards allied sectors like Dairying, providing standard income and employment to the farmers throughout year. Recently, health benefits associated with functional dairy products has created the awareness in consumers and entrepreneurs. Moreover, using milk alone may not enhance acceptability developed products, this problem can be solved by the way converting the milk into different value added dairy products for getting more profit with less investment for the benefit of small and medium farmers/ entrepreneurs. Apart from, consumer's acceptability of developed product is also an important factor while launching the new product in the market. Keeping in view of these factors, the present study was focused on to estimate the cost of production and profits associated with production of omega 3 enriched fruit (iron rich) yoghurt along with pilot consumers study of the developed product.

#### METHODOLOGY

The omega 3 enriched fruit yoghurt was prepared as per the procedure described by Tamime & Deeth (1980) with slight modifications for incorporation of flaxseed oil, flaxseed flour and fruits like sapota, dates and raisins. The cost of various components used in the manufacture of omega 3 enriched fruit yoghurt was taken into consideration. For the cost estimation of final product, certain set of assumptions like location, land and building, machinery and equipment, man power and capacity were made. The manufacturing cost of omega 3 enriched fruit yoghurt was calculated as per the guidelines suggested by Chauhan *et al.* (2006) and Chauhan *et al.* (2009).

#### Location, Land and building

The omega 3 enriched fruit yoghurt manufacturing unit was set up at own land of the entrepreneur in semi-urban area in Bangalore to make sure that there is easy supply of raw material especially milk and other ingredients. The land rent was taken at the rate of prevailing market rate of the particular area. The total working space required for omega 3 enriched fruit yoghurt unit was assumed to be 600 sq feet (20×30 sq. feet) and it was taken on rent (@₹10000 per month). The building includes processing section, store utilities section and office room.

#### Details of the Equipments, man power and Capacity

Capital investment (₹10,00,000) includes the cost of

all equipments viz. pasteurizing vat & its accessories, manual cup filling machine, incubator room and mini cold store (3m×3m×3m). Depreciation on machinery and equipments was taken @10 per cent per annum. Interest on capital investment and variable cost was taken @12 per cent per annum. One skilled and two unskilled people were required for manufacturing omega 3 enriched fruit yoghurt. The working days for the year were assumed to be 300 days. As per the Government order, the wages for the manpower would be ₹277.72 per day for unskilled and ₹342.22 per day for skilled Labour. One batch of omega 3 enriched fruit yoghurt was made from total of 100 kg raw materials in 8 hours time. Hence, for properly utilizing the labour and other resources in a day.

#### Marketing and distribution

The finished product was directly sold to the retailers/ consumers as per demand from the factory itself. So, the calculated cost of production as well as profit per batch is ex-factory before taxes. It does not include any marketing and distribution charges.

#### Break-Even Output

The concept of break-even analysis deals with the contribution margin of a product. Breakeven analysis is used to find out when the business will be able to cover all its expenses and begin to make a profit. It is important to identify startup costs, which will help to determine the sales revenue needed to pay ongoing business expenses. A firm will continue its production process or will remain solvent as long as the total revenue is greater than or equal to the total cost. Break even output provides us with an estimate of the output produced at that level.

Break Even point= Total Fixed Cost/ (Sales price per unit-Variable cost per unit)

Margin of safety =  $\frac{\text{Actual production} - \text{Break even output}}{\text{Actual production}} \times 100$

#### Pilot Consumer Study

The developed functional yoghurt was served to regular consumers of yoghurt to understand the consumers opinion about the product. A group of 100 consumers were randomly selected. Care was taken to include the consumers from both the sexes, different age groups, different income groups and students. The consumers were provided with a small and simple questionnaire to comment and record their opinion about the product. The data was compiled and reported.

#### RESULTS AND DISCUSSION

Fruit yoghurt is a popular fermented product available in market. However, milk is a poor source a omega 3 fatty acids and iron content, to solve this problem, there is an urgent need to develop omega 3 fatty acids enriched fruit (Iron rich) yoghurt so that it will be available in the market for consumer benefit purpose. On its own, the human body cannot make omega-3 fatty acids and so they must be obtained from food or supplements. As more consumers become aware of the potential therapeutic benefits of omega-3 fatty acids on the

attenuation of chronic inflammation, an increased interest and demand for food and beverage products containing omega-3 fatty acids is increasing. Cost of production is one of the most important factors for the commercial viability of any enterprise. Cost is the important factor for determining its feasibility before launching product. The cost of each ingredient prevailing in the market is taken into consideration while calculating the cost of production. The cost of omega 3 enriched fruit yoghurt and profitability were estimated and detailed categorization of different cost components into per unit fixed, variable and total cost are presented and summarized in succeeding sections.

Capital investment (₹10,00,000) includes the cost of all equipments viz. pasteurizing vat & its accessories, manual cup filling machine, incubator room and mini cold store (3m×3m×3m). The costing methodology will breakup and categorize the overall cost of manufacturing the omega 3 enriched fruit yoghurt into its different components i.e. fixed costs and the variable costs.

**Fixed cost**

The annual fixed cost of omega 3 enriched fruit yoghurt unit comprises of depreciation on equipments, interest on capital investment and building rent which has been presented in Table 1. A perusal of the table revealed that total fixed cost per annum was found to be ₹3,40,000 out of which major share was on building rent (₹1,20,000) followed by ₹1,20,000 on interest on capital investment and ₹1,00,000 on depreciation on equipments. The fixed cost per day was observed to be ₹932 per day.

**Variable Cost**

Variable cost for omega 3 enriched fruit yoghurt nuggets include the cost of various raw materials, labour, electricity, laboratory charges, cleaning and packaging material used in a batch of 100 kg product as shown in Table 1. Raw materials are mixed milk, skim milk powder, flaxseed oil, flaxseed flour, sugars and fruits like sapota, dates and Raisins (Table 1). The total expenditure on raw materials was observed to be ₹6528.5 out of which major share was of milk, ₹2073.5 (31.75 per cent) followed by flaxseed oil with ₹2000 (30.63 per cent) and fruit mixtures with ₹1250 (19.15 per cent). The total variable cost per batch was observed to be ₹9338. Adding fixed cost to this total variable cost, total cost worked out to be ₹10270.

**Returns**

The yield of final product was 100 kg and cost per kg of final product was observed to be ₹102.7. Sale price of final product was taken at ₹120/kg. The gross return from per batch was worked out to be Rs 12,000. The net return per batch was ₹1730. On monthly basis, the net returns turned out to Rs 51,900. It means a person engaged in this activity can earn more than ₹50000 a month. Benefit cost ratio was worked out to be 1.17 which far more than one indicating good profitability from this enterprise. Breakeven point in output was found to be 35.01 kg, but

actually we are preparing 100 kg per day. It implied that our business is viable and we are having good margin of safety (64.99 per cent) against the fluctuations in market prices. These results are in line with those reported by Kumar et al. (2016) who found that margin of safety in preparation of ready to eat –paneer nuggets was as high as 78.2 per cent.

**Pilot Consumer study on the acceptability of omega 3 enriched fruit yoghurt**

The fruit yoghurt made by incorporation of flaxseed sources was made and packed in 100 ml polystyrene cups distributed to about 100 persons who were consuming yoghurt regularly. Among the consumers,

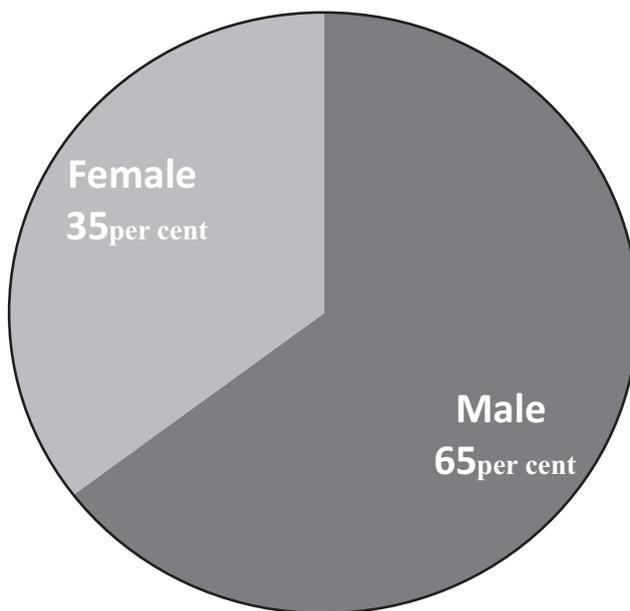


Figure 1: Consumer Details

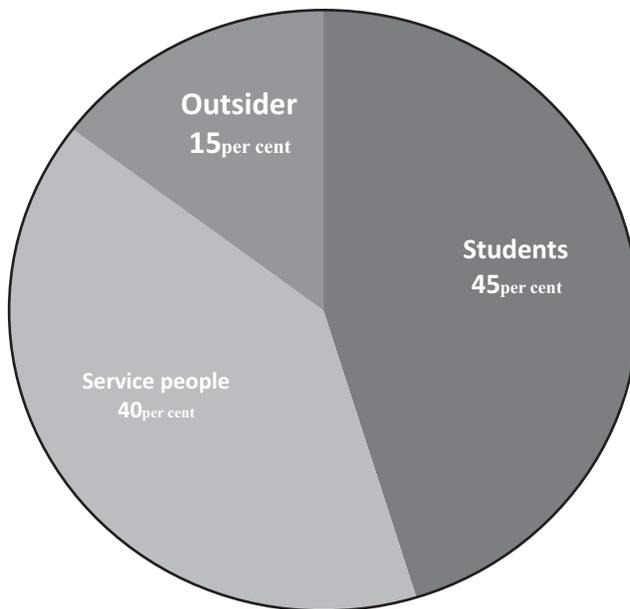


Figure 2: Breakup of the consumers

**Table 1: Cost analysis for production of 100 kg Omega 3 enriched fruit yoghurt**

Sr. No.	Particulars	Cost (₹)
	<b>Total capital investment required</b>	<b>10,00,000</b>
<b>A.</b>	<b>Fixed cost</b>	
a.	Depreciation on equipments @10per cent p.a.	1,00,000
b.	Interest on capital investment @12per cent p.a.	1,20,000
c.	Building rent per annum	1,20,000
	Fixed cost per annum	340,000
	<b>Total fixed cost per day (batch 100 kg) (A)</b>	<b>Rs. 932</b>
<b>B.</b>	<b>Variable cost</b>	
	<b>Quantity required per batch (100 kg mixture)</b>	<b>Cost (₹)</b>
a.	Raw materials	
	a. Milk	71.5 liters @Rs 29.litre
	b. Skim milk powder	1.5 kgs@250/kg
	c. Culture	4kgs@100/kg
	d. Flaxseed oil	2kgs@1000/kg
	e. Flaxseed flour-	1kg@80/kg
	f. Sugar	10 kg @35/kg
	g. Fruit mixtures-	@40/kg
	h. Sapota-5 kgs	@150/kg
	i. Dates-3kgs	2kgs @300/kg
	j. Raisins-2Kgs	
	<b>Total raw materials cost/ batch</b>	<b>6528.50</b>
b.	Labour @ ₹277.72 per day for unskilled and ₹342.22/ day for skilled	Unskilled= 02 Skilled = 01
c.	Electricity @ 8/unit	49
d.	Laboratory charges@ 0.2 per cent of raw materials	
e.	Cleaning and sanitizing materials@ 0.1per cent of raw materials	
f.	Packaging material@ ₹1.50/ polystyrene cups	1000 Cups
	<b>Total variable cost per day (per batch) (B)</b>	<b>9338</b>
	<b>Total cost of the batch = A+B</b>	<b>10270</b>
<b>C.</b>	<b>Returns per batch (100 kg)</b>	
	Yield per batch	100 kg
	Total cost per kg	102.7
<b>D.</b>	Sale price per kg	120.00
	Gross return	12000
	Net return	1730
	Net returns from month	51900
<b>E.</b>	<b>Profit per kg (Before taxes)</b>	<b>17.30</b>
	<b>BC ratio</b>	<b>1.17</b>
	<b>Breakeven point</b>	<b>35.01</b>
	<b>Margin of safety per cent</b>	<b>64.99</b>

nearly 65 per cent were male and remaining 35per cent were female consumers (Figure 1). The breakup of the consumers presented in Figure 2 shows that among the consumers nearly 45per cent were students, 40 per cent were service people and remaining 15 per cent regular outside. Age group distributed in the Figure 3 indicates that 42 per cent of the consumers were in the age group of 21-30 years, 25 per cent were in 30-40 years group, 16 per cent were in 40-50 years group, 16 per cent were in 51-60 years group and 1 per cent was above 60 per cent. When

the respondents were requested to indicate the reason to buy the developed product, 90 per cent of the respondents who liked the product reported that they would like to buy the product for the health benefits and nearly 10 per cent reported to buy as a novelty product. The Figure 4 shows that yoghurt consumers, nearly 94 per cent consumers liked the product, while 6 per cent of the consumers disliked the product mainly due to typical flaxseed flour flavour. The degree of liking among the respondents which is presented in Figure 5 shows that

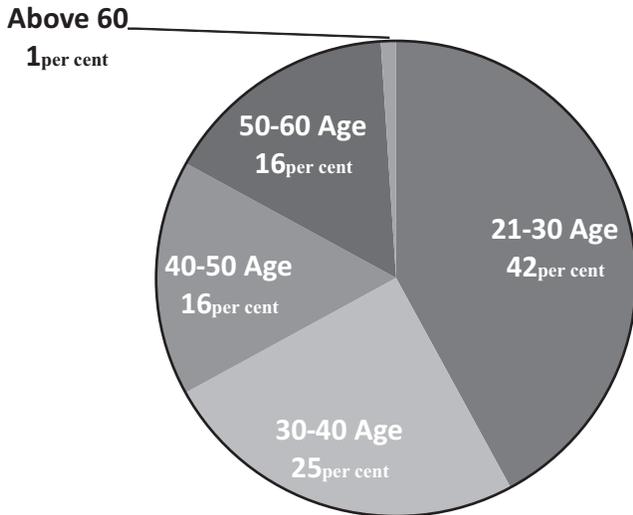


Figure 3: Age group of the respondents



Figure 5: Degree of liking among consumers

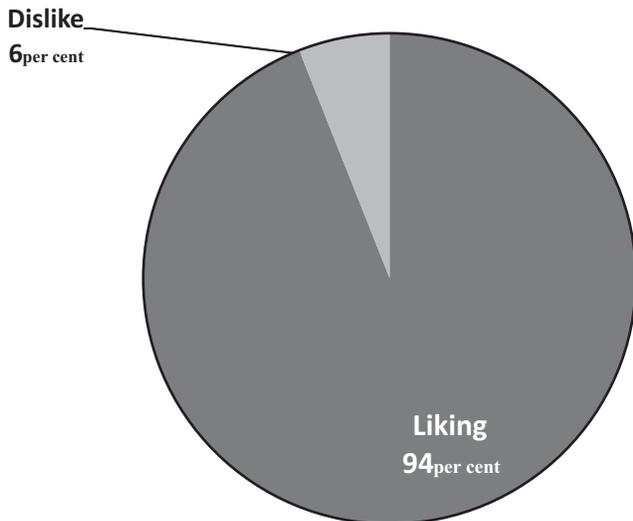


Figure:4 Preference among consumers

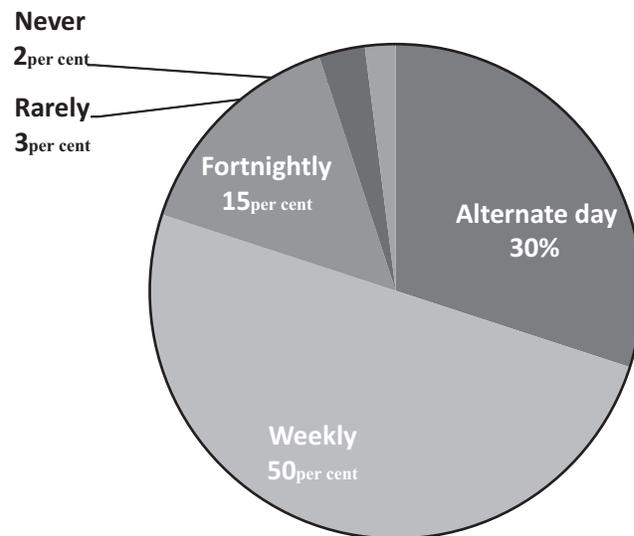


Figure 6: How often take the product

nearly 35 per cent described the product as excellent and 40 per cent as very good, while remaining 25 per cent expressed the product as good. Among the respondents who liked the product, in Figure 6, 30 per cent of them were interested in buying on alternate day, while 50 per cent were interested to consume on weekly basis and 15 per cent of respondents showed interest to buy fortnightly. About 3 per cent reported that they would buy the product rarely. It was observed that expenditure and priority of the product over other food ingredients were constraints among the respondents who showed interest to buy the rarely or fortnightly. Altogether the product was well accepted by the consumers. The investigation revealed that acceptable quality fruit yoghurt can be prepared by

incorporating 2 per cent flaxseed oil and 1 per cent flaxseed flour. The yoghurt had appreciable amount of omega -3 fatty acids and iron content when compared to those in control fruit yoghurt.

#### SUMMARY AND CONCLUSIONS

It may be concluded from the foregoing discussion that enterprise of omega 3 enriched fruit yoghurt preparation can be started with initial capital investment of ₹10,00,000. Total fixed cost per annum was found to be ₹3,40,000 and the fixed cost per day was observed to be Rs 932/day. The total expenditure on raw materials was observed to be Rs 6528.5 out of which major share was of milk that is, ₹2073.5 (31.75 per cent) followed by flaxseed oil with ₹2000 (30.63 per cent) and fruit mixtures

with ₹1250 (19.15 per cent). The total variable cost per batch was observed to be ₹9338. Adding fixed cost to this total variable cost, total cost worked out to be ₹10270. The net returns per batch was ₹1730. On monthly basis, the net returns turned out to ₹51,900. It means a person engaged in this activity can earn more than ₹50,000 a month. Benefit cost ratio was worked out to be 1.17 which far more than one indicating good profitability from this enterprise. Breakeven point in output was found to be 35.01 kg, but actually we are preparing 100 kg per day. It implied that our business is viable and we are having good margin of safety against the fluctuations in market prices. It was observed that expenditure and priority of the product over other food ingredients were constraints among the respondents who showed interest to buy the rarely or fortnightly. Altogether the product was well accepted by the consumers. Hence, this activity can be taken up as enterprise by the individuals for enhancing their income levels and for generating employment besides being self employed.

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## Consumer Satisfaction in e-shopping: An Overview

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### ABSTRACT

Worldwide business-to-consumer (B2C) sales will touch \$1.92 trillion. Everyday companies are adopting newer communication and information technologies to maintain and enhance their performances. Attracting new customers is challenging task in this competitive environment, therefore retaining existing customers is extremely important for survival. Studies have found that higher customer satisfaction translates into higher future profits, repeat purchase and positive word of mouth. As a result, marketers and researchers consider satisfaction as an important practical and theoretical issue. There have been many studies which decipher satisfaction and its interrelationship with other concepts. This paper integrates these diverse studies to provide a conceptual basis for understanding existing research.

### Keywords

Consumer satisfaction, online shopping

### JEL Code

M31, M37, M15

### INTRODUCTION

Worldwide business-to-consumer (B2C) e-commerce sales will touch \$1.92 trillion (Statista.com, 2016). This growth is attributed to increase in number of online and mobile users in emerging markets, boom in mobile commerce, better shipping and payment options, and entry of major brands in international markets. E-commerce companies are experimenting with their business models to attract and expand their customer base (Kalia, 2015) or banking on their deep pockets, strong domain knowledge and international exposure. Competition is so stiff that in countries with underdeveloped e-commerce ecosystem such as India, e-retailers are deploying large chunks of their investments to build infrastructure like fulfillment and logistics on their own (Kalia *et al.*, 2016; PWC & ASSOCHAM, 2014). Customer satisfaction has been found vital for success and survival of any traditional or online business system (Ho & Wu, 1999). Many studies have indicated that customer satisfaction can positively influence

customers' future purchase intentions (Kalia *et al.*, 2016; Taylor & Baker, 1994), customer retention (Gustafsson *et al.*, 2005) and satisfied customers engage in positive word-of-mouth advertising by sharing their favorable experiences with others (File & Prince, 1992; Richins, 1983). As a result, marketers and researchers consider satisfaction as an important practical and theoretical issue (Jamal, 2004). Earlier, web presence and low prices were believed to be key drivers of success but now online stores have realized importance of customer satisfaction (Fang *et al.*, 2011), because higher customer satisfaction is believed to be best indicator of firms future profit (Kotler, 2000), product or service performance (Anderson & Sullivan, 1993), adaptation or disconfirmation (Oliver, 1980) and post-purchase behavior (e.g., repurchase, complaining) (Anderson & Sullivan, 1993; Lin *et al.*, 2005; Oliver, 1993). Heskett *et al.*, (1994) mentioned about the service profit chain and linked internal operational factors such as service delivery system and employee capabilities with external service performance

such as customer satisfaction, loyalty, revenue growth, and profit. Before hashing out various studies related to consumer satisfaction in online context, next section will discuss definitions of consumer.

### Definition of Consumer Satisfaction

Early satisfaction concepts have usually outlined satisfaction as a post alternative analysis judgment regarding a specific purchase call (Oliver, 1980; Oliver & Desarbo, 1988). Satisfaction has been interpreted as process or an outcome (Parker & Mathews, 2001). In process definition, disconfirmation paradigm has been emphasized i.e. customers compare performance with expectations and decide about confirmation or disconfirmation (Oliver & Desarbo, 1988). Kotler (2000) also defined satisfaction as, "person's feelings of pleasure or disappointment resulting from comparing a product perceived performance or outcome in relation to his or her expectations". There are researchers who emphasized that satisfaction is outcome of service quality (Bitner *et al.*, 1990; Parasuraman *et al.*, 1988, 1985; Pitt *et al.*, 1995), cognition and affect (Homburg, Koschate, & Hoyer, 2006; Oliver, 1980) or perception, evaluation and psychological reactions to the consumption experience with a product or service (Yi, 1990). In the case of e-services customers give less importance to expectations as comparison standard (Zeithaml *et al.*, 2000). Instead, they keep traditional services as benchmarks (Riel, Liljander, & Jurriens, 2001) and use experience-based norms (Cadotte *et al.*, 1987).

### Studies Related to Consumer Satisfaction in Online Context

Some of the studies related to consumer satisfaction in online context are briefly discussed below.

Ho and Wu (1999) found that product, information and technological characteristics along with homepage presentation, and logistical support can moderate customer satisfaction.

Szymanski and Hise (2000) examined the factors that make consumers satisfied with their e-retailing experiences and found that convenience, site design, and financial security are the dominant factors in consumer assessments of e-satisfaction.

Jones *et al.* (2000) observed that effectiveness of core-service satisfaction on repurchase intentions becomes weak in case of high switching barriers conditions. In case of high satisfaction there is no influence of switching barriers on repurchase intentions, but when satisfaction is low the influence of switching barriers on repurchase intentions gets high.

Kim and Lim (2001) focused on the attributes of the Business-to-Consumer websites and observed that consumers' Internet shopping satisfaction is influenced by information quality, speed, reliability and entertainment. Further they recommended adding entertainment factor with good information to increase customer satisfaction.

Koivumäki (2001) observed that map-type interface can

enhance shopping experience in a computer mediated shopping environment and there exist a highly positive relationship between amount of purchases and consumer satisfaction level.

Cho and Park (2001) proposed electronic commerce user-consumer satisfaction index (ECUSI) instrument which reflects consumer satisfaction, user information satisfaction and electronic commerce. ECUSI consists of ten factors i.e. product information, additional information services, delivery time and charge, consumer services, product merchandising, ease of use, purchase result and delivery, site design, payment methods and purchasing process.

Bhattacharjee (2001) researched influence of cognitive beliefs and affect on information systems (IS) use continuance, by adapting expectation-confirmation theory. His results suggested that satisfaction and perceived usefulness with respect to IS determines users' continuance intentions. He also found that perceived usefulness and confirmation of expectation from prior IS use can shape user satisfaction. After acceptance, users' confirmation level influences perceived usefulness.

Petrick *et al.* (2001) suggested that revisit intention of entertainment vacationers can be predicted through past behavior, satisfaction, and perceived value. However, these variables poorly predict intention to attend live theater entertainment or booking of entertainment package during a visit.

Madu and Madu (2002) described fifteen dimensions (performance, structure, reliability, serviceability, trust, product/service differentiation and customization, reputation, assurance, features, aesthetics, storage capability, security and system integrity, responsiveness, web store policies and empathy) that are perceived by customers as a necessity in achieving customer satisfaction in a virtual operation

Devaraj *et al.* (2002) used structural equation modeling to identify the importance of perceived ease of use and usefulness in forming consumer attitudes and satisfaction with the EC channel. They also empirically proved that one of the SERVQUAL dimension i.e. assurance determines EC channel satisfaction.

McKinney *et al.* (2002) synthesized two perspectives i.e. user-satisfaction literature in IS and the customer-satisfaction literature in marketing to identify nine key constructs (relevance, timeliness, reliability, scope, perceived usefulness, access, usability, navigation, interactivity) for analyzing Web-customer satisfaction.

Yang *et al.* (2003) studied about service quality in realm of the context of Internet retailing and revealed that predominant service attributes leading to consumer satisfaction are responsiveness, convenience, credibility, reliability and ease of use.

While developing scale for measuring quality of e-tail Wolfenbarger and Gilly (2003) discovered that customer loyalty, judgement of quality and satisfaction and attitudes towards the website can be predicted through

factors like customer service, fulfillment/reliability, website design and privacy/security.

Jun *et al.* (2004) keyed out access, attentiveness, credibility, reliable/prompt responses, ease of use and security as six major service quality dimensions in case of online retail. They noticed that reliable/prompt responses, attentiveness, and ease of use had significant impacts on satisfaction.

Bhattacharjee and Premkumar (2004) conducted a longitudinal study and reported that changes in IT users' beliefs and attitudes can be understood through important factors like disconfirmation and satisfaction. Similarly, Hsu *et al.* (2006) presented a model based on Theory of Planned Behavior (TPB) by incorporating two Expectation Disconfirmation Theory (EDT) constructs i.e. disconfirmation and satisfaction for studying users' continuance intention in the online shopping context

Shih (2004) empirically proved that individual's e-shopping attitudes can be predicted through perceived usefulness (PU) and perceived ease of use of trading online (PEOUT). Further, user acceptance is affected by user's perceptions of information, system, internet satisfaction and service.

Yang and Fang (2004) conducted an exploratory research to understand service quality and customer satisfaction within the setting of online securities brokerage services and noticed that primary service quality dimensions, except ease of use lead to online customer satisfaction. Whereas information systems quality factors led to dissatisfaction.

Kim and Stoel (2004) examined the website attributes that favorably affect consumer satisfaction and found that shopper satisfaction can be predicted through website quality dimensions (informational fit-to-task, response time and transaction capability). Lin *et al.* (2005) investigated the value of including 'playfulness' in expectation-confirmation theory (ECT) and proposed that factors which lead to users' intent to reuse a web site are confirmation to satisfaction, perceived playfulness and perceived usefulness.

Zhang and Prybutok (2005) focused their research to examine the factors that contribute to e-service and ascertained that consumers' satisfaction and intentions are affected by Web site service quality, service convenience and risk.

Balabanis *et al.* (2006) focused on two antecedents of e-store loyalty, perceived switching barriers and satisfaction. Difference in impact of switching barriers at different levels of customer satisfaction was found.

Yang (2007) modified the D&M IS Success Model by adding E-S-Qual and formulated a website loyalty model. He found that e-satisfaction is affected by service and information quality which further effects e-loyalty.

Cristobal and Flavia (2007) indicated that perceived quality is a multidimensional construct (assurance, web design, order management and customer service) which can influence satisfaction, which further regulates

consumer loyalty.

Ranaweera *et al.* (2008) deployed SEM and found that the personality characteristics have significant moderating effects on online purchase intentions. They also found that risk aversion can increase the likelihood of purchase when consumers are satisfied and technology readiness increases the likelihood of online purchase.

Nosrati (2008) surveyed Iranian online book shoppers and suggested that e-trust affects satisfaction through quality. Reliability was found to be critical indicator of quality.

To understand the bearing of website quality on purchase intentions and customer satisfaction Bai *et al.* (2008) empirically formulated a conceptual model. They noticed a direct and positive impact of website quality on customer satisfaction, which further positively influences purchase intentions.

Hsu (2008) proposed an index for online customer satisfaction by adapting American Customer Satisfaction Index (ACSI) and found factors like e-SQ, trust and perceived value significantly influence overall customer satisfaction.

Collier and Bienstock (2009) observed a significant relationship between customer satisfaction and outcome and recovery quality, however any significant relation with behavioral intentions was not found. They remarked that outcome and recovery quality have impact on patronage intentions in future, which is mediated through customer satisfaction.

Herington and Weaven (2009) measured e-service quality for e-retail banking and proposed a four-factor solution (personal needs, site organization, user-friendliness and efficiency) that predicted overall customer satisfaction with banking performance except efficiency.

Kim *et al.* (2009) examined an e-loyalty development model and found that the e-loyalty development process is regulated by e-trust and e-satisfaction. They also found that two of the e-tail quality dimensions i.e. fulfillment/reliability and Website design positively influences e-satisfaction.

Roy and Butaney (2010) classified six dimensions of website quality for the online retail websites, of which interactivity features, website appearances, site organization and navigational quality have significantly bearing on e-satisfaction and the customer's affective attitude towards the website.

Gounaris *et al.* (2010) examined the effects of service quality and satisfaction on three consumer behavioral intentions, namely word-of-mouth, site revisit, and purchase intentions in the context of internet shopping and revealed that e-service quality has a positive effect on e-satisfaction.

While examining the determinants of the B2C e-commerce customer satisfaction Eid (2011) found significant positive impact of information and user-interface quality of electronic commerce websites on consumer satisfaction.

**Table 1: Factor affecting consumer's satisfaction in online context**

Study	Mediating Element
Ho and Wu (1999)	Logistical support, technological characteristics, information characteristics, homepage presentation, and product characteristics
Szymanski and Hise (2000)	Convenience, site design, and financial security
Jones et al. (2000)	Switching barriers
Kim and Lim (2001)	Entertainment, speed, information quality and reliability
Koivumäki (2001)	Map-type interface.
Cho and Park (2001)	Product information, additional information services, delivery time and charge, consumer services, product merchandising, ease of use, purchase result and delivery, site design, payment methods and purchasing process
Bhattacharjee (2001)	Cognitive beliefs and affect
Petrick <i>et al.</i> (2001)	Past behavior, perceived value
Madu and Madu (2002)	Performance, structure, reliability, serviceability, trust, product/service differentiation and customization, reputation, assurance, features, aesthetics, storage capability, security and system integrity, responsiveness, web store policies and empathy
Devaraj <i>et al.</i> (2002)	Perceived ease of use and usefulness
McKinney <i>et al.</i> (2002)	Relevance, timeliness, reliability, scope, perceived usefulness, access, usability, navigation, interactivity
Yang <i>et al.</i> (2003)	e-service quality dimensions (responsiveness, convenience, credibility, reliability and ease of use)
Wolfenbarger and Gilly (2003)	Customer service, fulfillment/reliability, website design and privacy/security
Jun <i>et al.</i> (2004)	Online retailing service quality dimensions (reliable/prompt responses, attentiveness, and ease of use)
Shih (2004)	Perceived ease of use and perceived usefulness
Yang and Fang (2004)	Responsiveness, service reliability, ease of use, competence, access, system reliability, timeliness, security
Kim and Stoel (2004)	Website quality dimensions (transaction capability, informational fit-to-task and response time)
Lin <i>et al.</i> (2005)	Perceived playfulness, perceived usefulness
Zhang and Prybutok (2005)	E-service (service convenience, Web site service quality, and risk)
Balabanis <i>et al.</i> (2006)	Switching barriers
Yang (2007)	Service quality and information quality
Cristobal and Flavia (2007)	Perceived quality (web design, customer service, assurance and order management)
Ranaweera <i>et al.</i> (2008)	Web site satisfaction and technology readiness
Nosrati (2008)	Quality, e-trust
Bai <i>et al.</i> (2008)	Website quality
Hsu (2008)	e-SQ, trust and perceived value
Kim <i>et al.</i> (2009)	etail quality dimensions (fulfillment/reliability and Website design)
Collier and Bienstock (2009)	Outcome quality and recovery quality evaluations
Herington and Weaven (2009)	Personal needs, site organization and userfriendliness
Roy and Butaney (2010)	Website quality dimensions (navigational quality, website appearances, interactivity features and site organization)
Gounaris <i>et al.</i> (2010)	e-service quality
Eid (2011)	User interface quality and information quality
Finn (2011)	Download speed
Wu <i>et al.</i> (2011)	Virtual community cohesion
Limbu <i>et al.</i> (2011)	Non-deception, fulfillment, and security
Kuo and Wu (2012)	Perceived justice (distributive, procedural, interactional) and emotions
Abu and Mohammad (2013)	Internet shopping emotional state (stimulation, pleasure and dominance)
Moon (2013)	e-service quality
Khan <i>et al.</i> (2015)	Price, convenience, product information, return policy, financial risk, product risk and delivery risk

Finn (2011) tested non-linear effects of the dimensions of e-service quality on customer satisfaction and identified download speed as a must-be performance dimension. Wu *et al.* (2011) observed that virtual community cohesion play a moderating role between the relationship

of the online game service quality and satisfaction. Limbu *et al.* (2011) examined the effects of consumers' perceptions concerning the ethics of online retailers on web site satisfaction and loyalty and revealed that non-deception, fulfillment, and security are significant

predictors of web site satisfaction.

Kuo and Wu (2012) in their results indicated that distributive justice can enhance positive emotions and reduce negative emotions; additionally it enhances post-recovery satisfaction and post-purchase intentions within customers. They also observed that post-purchase intentions are positively affected by post-recovery satisfaction.

Abu and Mohammad (2013) found that emotional states such as stimulation, pleasure and dominance can positively affect e-satisfaction during internet shopping. In contrast, remote purchase perceived risk dimensions (which include different types of risks i.e. total, financial, social, psychological, functional and physical) have no impact on e-satisfaction, except negative impact of risk of time loss.

Moon (2013) explored the effect of e-service quality on customer satisfaction and loyalty in the area of Business-to-Customer (B2C) and their results depicted significant effectiveness of e-service quality in improving customer satisfaction and loyalty.

Khan *et al.* (2015) probed to know perceived factors which can affect customer satisfaction to re-purchase intention with respect to online stores. Their analysis indicated that seven factors i.e. three types of risk factors (delivery, product and financial) and four other factors like return policy, convenience, price and product information can significantly affect customer satisfaction to re-purchase intention with respect to online stores.

## **CONCLUSION AND MANAGERIAL IMPLICATIONS**

This literature review pertaining to consumer satisfaction in online context helped in identifying few of the most important factors having significant influence on e-satisfaction. These factors are summarized below along with the managerial implications.

### **Site design**

Site design is extremely important as it creates the first impression of the online retailer and helps in driving traffic, making people stay, and finally convincing first time visitors to purchase product (Bai *et al.*, 2008; Ranaweera *et al.*, 2008). Therefore design of an online shop should offer enough information to compare products (Cristobal & Flavia, 2007), give greater sense of credibility, integrity and reliability in user interface to reduce privacy concerns of consumers (Eid, 2011), interactive, easy to navigate, simple and aesthetically pleasing (Roy & Butaney, 2010; Szymanski & Hise, 2000), offer faster response (Kim & Stoel, 2004), fun, immersive and community-oriented (Wolfenbarger & Gilly, 2003), fast, informative, uncluttered, (Kim *et al.*, 2009) and should consider cultural and language issues (Zhang & Prybutok, 2005)

### **Reliability**

Reliability has been interpreted in number of ways and it can be reflected in consistent performance over time,

availability of website for usage, accessibility, speed and download time, reliability in recording information and customer transactions (Madu & Madu, 2002), consumer privacy, payment, delivery/offline fulfillment (Kim *et al.*, 2009; Kim and Lim, 2001), accuracy of the product depiction and order (Wolfenbarger & Gilly, 2003), providing information that is trustworthy, accurate and credible (McKinney *et al.*, 2002), accuracy in record, quote, billing, calculation of commissions, service promise and keeping system free from clogging, failure and errors (Yang *et al.*, 2003; Yang & Fang, 2004)

### **Information**

In order to improve the satisfaction online retailer's websites should furnish the buyers with valuable information for shopping and permit them to see that the site has high-quality content (Kim & Lim, 2001). This information should be easy to understand, detailed, should describe exterior of a product, there should be provision for additional and delivery time information (Cho & Park, 2001). To furnish more product information retailers can use short video or 3-D images of the product, such clear and understandable information will assure the customer that product quality matches with website description and assures consumers that their financial information is in safe hands (Khan *et al.*, 2015). The website should allow customer to interact with it to receive tailored information (Kim & Stoel, 2004). Information provided by retailer should be reliable, understandable, well-organized and presented in an entertaining manner (Yang, 2007).

### **Security**

Online businesses should ensure the security of the transactions, provide a secure server, additional layers of security inbuilt in multiple payment options (e.g. credit card or paypal) and guarantee against credit card fraud (Limbu *et al.*, 2011). There should be provisions like log off or lock out after time-out, privacy of personal information, fund or trade hold-up, customer protection (Z. Yang & Fang, 2004), privacy and security policy (Wolfenbarger & Gilly, 2003), effective firewall and customer education (Madu & Madu, 2002).

### **Perceived usefulness**

To enhance the perceived usefulness of an online business website, website should provide information that is informative, valuable, useful, improves the quality of decision making to make final purchase (McKinney *et al.*, 2002), shopping online gives a feeling of greater control (Devaraj *et al.*, 2002; Lin *et al.*, 2005).

### **Ease of use**

Customers feel more satisfied if they feel that it is easy to do what they want to do while shopping online (Devaraj *et al.*, 2002), therefore online business should focus on building a website that is easily navigated, user friendly, fast, accessible, easy to check out and that provides the functions customers need (Yang *et al.*, 2003). These functions can be related to registering, adjusting registration or use of information (Cho & Park, 2001).

**Convenience**

Convenience is important for new or existing consumers and consumers' can experience of e-service is through the GUI interface, therefore online business should design interfaces for convenience and ease of use (Zhang & Prybutok, 2005). Many customers abandon their cart due to very lengthy process or problems in transfer money or non-acceptance of common money-paying cards (Khan *et al.*, 2015), hence online businesses should offer multiple payment options and fast check out processes. Efficient delivery and pick up options also add to customer convenience (Yang *et al.*, 2003).

**E-service quality**

Many of the factors discussed above are inherent in e-service quality. Majority of researchers have emphasized for e-service quality (Collier & Bienstock, 2006; Gounaris *et al.*, 2010; Jun *et al.*, 2004; Moon, 2013; Nosrati, 2008; Yang, 2007; Yang *et al.*, 2003; Zhang & Prybutok, 2005), therefore online marketers and businesses should focus on improving their service quality.

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## **Accessibility of Marginal and Small Farmers to Institutional Credit in South Western Punjab**

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### **ABSTRACT**

*Punjab agriculture has become capital intensive since the inception of 'Green Revolution'. Following technological change and greater need for credit to facilitate the adoption of technology, the question of small farmers' effective access to institutional finance is of crucial significance. Empirical evidence has indicated higher dependence of marginal and small farm categories on exploitative informal sources of credit, thus making them more vulnerable. It was found that factors like farm size, total annual income, location of the financial institutional agency and purpose of loan were affecting the availability of credit from formal sources of credit in case of sampled farmers. Then, low rate of interest, charged by institutional sources of finance and credit limits formed of borrowers by these agencies emerged as the primary reasons for preferring institutional sources of credit. While lesser formalities, timeliness and easy access were the factors weighing heavily in favour of non-institutional sources of finance.*

### **Keywords**

Accessibility, credit, marginal and small farmers, Punjab

### **JEL Codes**

Q10, Q14, E51, F65

### **INTRODUCTION**

In Punjab, a large proportion of the total population is still living in the rural area and most of them have been sustaining their livelihood through agriculture. Agricultural sector, in most of the developing countries, more so in India, is primarily small farm agriculture characterized by low income, low levels of operating capital and low investment in depreciable assets (Kahlon and Singh, 1984). The credit starvation of the agriculture sector symptomizes a vicious circle of low productivity, low income and low investment. Overtime increasing farm expenses associated with stagnant productivity has led to decline in income of the farmers. The financial requirements of the farmers surged with the transformation of agricultural sector on commercial lines. The demand for capital increased for variable and fixed expenses, which has increased the dependency on outside funding. Amongst all categories, the marginal and small farmers are the most affected in this regard. Punjab is one of the most progressive states of India in terms of agricultural development and having a much better distribution of land holdings than the Indian situation. Out

of 10.52 lakh total operational holdings, as per the agricultural census of 2010-11, the number of marginal and small holdings was 1.64 lakh (15.62 per cent) and 1.95 lakh (18.57 per cent), respectively (Anonymous, 2014). The area operated by these categories was 6.78 and 2.54 per cent respectively. In order to meet the increasing farm expenses, farmers have to resort to borrowing from different sources of finance. Farmers approach institutional as well as non-institutional sources of credit in order to meet their credit requirements, both for farm and consumption purposes. There exists wide variation with respect to access of institutional sources over the different farm size categories. Large farmers being more resourceful have better access to institutional credit as compared to small and marginal farmers. Empirical studies conducted in Punjab state have also highlighted more dependence of these categories on non-institutional sources of finance (Shergill, 1998; Sidhu *et al.*, 2000; Singh *et al.*, 2008). Therefore, the present study was designed to bring out the availability of institutional credit to marginal and small farm categories in debt and suicide prone south-western Punjab and the reasons of their

preference for different sources of finance.

## METHODOLOGY

Multi-stage random sampling technique was followed to draw a representative sample for the study. Out of the six districts of cotton belt, two districts namely Bathinda and Sri Mukatsar Sahib were randomly selected. Then, two blocks from each selected districts namely Lambi and Gidderbaha from Mukatsar district and Talwandi Sabo and Rampura Phool from Bathinda district were selected at random. At third stage, two villages from each selected block were selected and hence total eight villages were selected to carry out the study. At the last stage of sampling procedure, fifteen farmers from each selected village were selected. Thus, a total sample of 120 farmers comprising 60 marginal farmers (having operational land holding up to 2.5 acres) and 60 small farmers (with operational land holding of >2.5 acres & up to 5 acres) as per standard classification of land holdings representing a suitable sample was drawn from the area under study. Simple statistical techniques were used for the tabular analysis.

### Factors affecting extent and accessibility of institutional loan-Regression analysis

#### Model specification

Multiple linear regression analysis technique was used to determine the factors affecting the accessibility to institutional credit in terms of magnitude among sampled farm families in the study area. The linear form of regression model is given below:

$$Y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7 + b_8x_8$$

Where

Y = Magnitude of loan (₹)

X<sub>1</sub>: Farm size (acres)

X<sub>2</sub>: Total income (₹)

X<sub>3</sub>: Educational level (schooling years)

X<sub>4</sub>: Location of bank (located in the villages or not)

X<sub>5</sub>: Location of cooperative society

X<sub>6</sub>: Purpose of loan (productive and non-productive)

X<sub>7</sub>: Share of non-institutional credit

X<sub>8</sub>: Member of social organization

'a' is the constant term

and b<sub>1</sub> to b<sub>8</sub> are the coefficients in the multiple linear regression function.

#### Garrett's Ranking Technique

Garret's Ranking Technique has been used to rank the reasons given by the sampled farmers for the preference in favour of institutional and non-institutional sources of credit. The rank assigned to a particular reason by the sampled respondents was transmitted into scores using the formula given by Garrett and Woodworth (1981).

$$\text{Percentage position} = 100 * (R_{ij} - 0.5) / N_j$$

Where

R<sub>ij</sub> = Rank given for i<sup>th</sup> problem by the J<sup>th</sup> respondent

N<sub>j</sub> = Number of problems ranked by the J<sup>th</sup> respondent

By referring the Garrett table, the percent position estimated was converted into scores. Then for each

reason, the score of various respondents were added and mean score was calculated. The factor with highest mean score was considered to be the most important reason.

## RESULTS AND DISCUSSION

Socio-economic parameters like age, family composition, education level, operational farm size, social status etc of the sampled respondents were the most important indicators affecting the decision making in various aspects of agriculture production process. The general status, power to take decisions of the individual in the society is greatly influenced by the age of the individual. Overall in the study area majority of the respondent farmers, 55 per cent belonged to the age group of 45 to 60 years. Only 0.83 per cent of the total sampled famers belonged to relatively younger age group (less than 30 years), while 8.33 per cent were more than 60 years old. Category-wise, the proportion of sampled farmers having age between 45 to 60 years was higher among small farmers (56.67 per cent) as compared to marginal farmers (53.33 per cent). On an overall basis, average size of operational holding on sampled farms came to be 2.78 acres. The average operational area in the case of marginal and small farms worked out to be 1.58 and 3.98 acres, respectively. The average family size constituted 5.16 members per household in the study area. Majority of the famers (45 per cent) were found to be illiterate. One-fourth of the total sampled farmers attained education up to middle level. So far as cropping pattern is concerned cotton was the major crop in the kharif season being cultivated on 1.30 acres of land which constituted 23.38 per cent of the total cropped area" Basmati has emerged as second most important crop in the kharif season and occupied about 16 per cent of the total cropped area. In Rabi season, wheat was the major crop which covered about 46 per cent of the total cropped area. Fodder crop was cultivated only on 1.98 per cent of the total cropped area, while the vegetables and oilseeds crops in the Rabi season were cultivated on less than one per cent of the total cropped area. Source-wise, crop farming was the major source of income and more than 50 per cent of the total income (54.78 per cent) was generated from this source alone. Compared to small farmers, the share of total income generated from dairying, off-farm work, service, pension and other sources was very high among marginal farmers. On the whole, it may be concluded that crop farming and dairying were the main source of income of the sampled farmers as these sources together contributed more than 60 per cent of the total income in the south western Punjab. It was evident that the extent and the proportion of total income generated from off farm income by the marginal farmer were very high as compared to small farmers. The household expenditure pattern indicated that in south-western Punjab, average annual expenditure turned out to be ₹ 88658 per household, while the per farm household expenditure on small farms (₹101853 per annum) was higher than that of marginal farmers (₹75463 per annum).

The value of 't' statistics indicates that the expenditure pattern varied significantly across the marginal and small farms, respectively. Out of the total expenditure, the expenditure on food was the major cost item and the average amount of expenditure incurred by the sampled households was estimated at ₹38050 (42.92 per cent) on overall farms, while the respective figures on marginal and small farms worked out ₹33850 (44.86 per cent), and ₹42250 (41.48 per cent), respectively. on this item head followed by education expenditure and expenses incurred on intoxicants.

The farm inventory in terms of numbers and investment was estimated to be very high in the case of small farmers as compared to marginal farmers. In case of marginal farms, out of the total sampled farmers only 5 (8.38 per cent) owned tractor, while 47 per cent of the total small farmers tractors. The total farm investment on per farm basis came to be ₹15296 in the case of marginal farmers and ₹97613 in the case of small farmers, respectively. The t-test revealed that the extent of farm investment differ significantly among marginal and small farmers. Other major items of farms investments found were trolleys followed by diesel engines and submersible pumps on sampled farms.

Purpose and source wise extent of loan availed by farmers in south western Punjab during last 5 years (Table 1) showed that the extent of loan was higher in the case of small farmers (₹110001 per farm) as compared to marginal farmers (₹74333 per farm). In case of marginal farmers, an amount of ₹28833 and ₹45500 per farm was taken from institutional and non-institutional sources of credit which accounted for 38.79 and 61.21 per cent to the total loan availed by this category, while the respective figures in the case of small farmers came out to be 65.30 and 34.70 per cent, respectively. Out of the total loan, the

per cent share of total loan used by marginal farmers for productive purposes came to relatively low (41.93 per cent) as compared to small farmers (48.79 per cent). On the contrary, the per cent share of total loan used by marginal farmers for non-productive purposes was high (58.07 per cent) as compared to small farmers (51.21 per cent), respectively. It was found that share of total institutional loan utilized for productive purpose was very high among marginal farmers (69.36 per cent) as compared to small farmers (44.08 per cent). Similarly, the share of total non-institutional loan used by the marginal farmers (75.46 per cent) for non-productive purpose was very high (75.46 per cent) as compared to small farmers (42.36 per cent). Although the total institutional loan availed by the marginal farmers for productive purposes was less than small farmers in absolute terms, but it was very high among marginal farmers in terms of per cent share.

In the case of marginal farmers, major share (70.05 per cent) of the total productive loan was utilized for developing irrigation structures, while in case of small farmers, 66.15 per cent of it was used for upgrading farm equipments and implements. Diversion of total loan towards non-productive purpose was more in case of marginal farmers and nearly 47 per cent of the total non-productive loan was utilized for house construction. Similarly more than half (53 per cent) of the total non-productive loan was used for home construction in the case of small farmers.

Season-wise, the extent of loan availed by the marginal farmers was more in *khari* season (₹33717/farm) as compared to *Rabi* season (₹29433/farm) which accounted for 53.39 and 46.61 per cent, while the extent of loan availed by the small farmers corresponding to respective season came out as ₹110667

**Table 1: Purpose-wise and source wise loan availed by the sampled farmers during last 5 year in south western Punjab (2010-11 to 2014-15)**

Purpose	Marginal		Small		Overall	
	Amount	Per cent to total	Amount	Per cent to total	Amount	Per cent to total
<b>Productive purpose</b>						
Institutional	20000	64.17	31667	59.01	25833	60.90
Non-institutional	11167	35.83	22000	40.99	16583	39.10
Sub-total	31167	100.00	53667	100.00	42417	100.00
<b>Non-productive purpose</b>						
Institutional	8833	20.46	40168	71.30	24501	49.25
Non-institutional	34333	79.54	16167	28.70	25250	50.75
Sub-total	43167	100.00	56334	100.00	49751	100.00
<b>Total Loan</b>						
Institutional	28833	38.79	71834	65.30	50334	54.61
Non-institutional	45500	61.21	38167	34.70	41833	45.39
<b>Grand total</b>	<b>74333</b>	<b>100.00</b>	<b>110001</b>	<b>100.00</b>	<b>92167</b>	<b>100.00</b>

Figures in the parentheses represent the percent share to the total loan

(57.31 per cent) and ₹82433 (42.69 per cent), respectively. Out of the total loan, availed the share of commercial banks, cooperative institutions, commission agents, landlords and relative/friends came out 14.78, 8.16, 65.06, 8.31 and 3.69 per cent respectively in case of marginal farmers. However, in the case of small farmers the share of commercial banks, cooperative institutions, commission agents and landlords estimated at 38.15, 7.11, 51.92 and 2.82 respectively, while none of the small farmer availed loan from relative/friends (Table 2).

**Factors Affecting the Extent of Institutional Credit Availed by Sampled Farmers**

**Regression analysis**

Multiple regression analysis was carried out to measure the contributory affect of various socio-economic factors on the access and extent of institutional loan availed in terms of magnitude of loan among marginal and small sampled farm households. Eight socio-economic factors, namely farm size, total annual income of farm households from all sources, education level of the head of household, location of bank, location of cooperative society, purpose of loan, share of non-institutional sources in total loan amount and member of any social organization were included in the model for multiple regression analysis. The regression coefficients along with their standard error and percent contribution in explaining the variation, Coefficient of Multiple Determination (R<sup>2</sup>) have been presented in Table 3.

The results indicated that on marginal farms, out of eight factors only three factors namely farm size, total annual income and location of cooperative society were significantly contributing towards the access to institutional credit. The value of regression coefficients showed that with one unit improvement in farm size and income level of the marginal farmers, the extent of institutional loan would be increased by ₹110359.08 and ₹0.62 per farm, respectively. It was noted here that the

**Table 3: Factors affecting access to institutional credit (₹)**

Factors	Marginal	Small
Intercept	-154574.08**	-54253.80**
Farm size	110359.08**	103319.04*
Total income	0.62**	-0.59**
Education level	1089.73	1623.73
Location of bank	-16286.38	13818.60
Location of society	-42115.15*	16821.29
Purpose of loan	-33317.66	144803.39*
Share non-institutional	-549.88	-2640.20**
Member of Social Organization	-5392.16	-16320.91
<b>R<sup>2</sup></b>	<b>0.7913</b>	<b>0.7981</b>

\*\* and \* significant at one and five per cent level, respectively.

dependency of marginal farmers on cooperative societies for acquiring farm inputs was relatively more as compared to cash loan and therefore the location of cooperative societies has been depicting negative relationship with the extent of institutional credit. It was also evident from the results that with one per cent improvement in terms of location of cooperative societies would decrease the magnitude of institutional loan by ₹42115.15 per farm among marginal farm households in the study area. This was due to the fact that majority of sampled marginal farmers were not the member of village cooperative society and also reported that the functioning of cooperative societies was ineffective in particular location. The value of R<sup>2</sup> revealed that 79.13 per cent of the total variation in the extent of institutional loan was explained by the factors included in the model.

Similarly, on small farms four factors namely farm size, total annual income, purpose of loan and share of

**Table 2: Source-wise extent of seasonal/short term loan availed by the sampled farmers in south western Punjab, 2014-15**

Source of loan	Marginal			Small			Overall		
	Kharif	Rabi	Total	Kharif	Rabi	Total	Kharif	Rabi	Total
<b>A. Institutional sources</b>									
Commercial bank	5250	4083	9333	40500	33167	73667	22875	18625	41500
Cooperative institutions	2633	2517	5150	7417	6317	13733	5025	4417	9442
<b>Sub-total (A)</b>	<b>7883</b>	<b>6600</b>	<b>14483</b>	<b>47917</b>	<b>39483</b>	<b>87400</b>	<b>27900</b>	<b>23042</b>	<b>50942</b>
<b>B. Non Institutional sources</b>									
Commission agent/Arthiya	21917	19167	41083	59833	40417	100250	40875	29792	70667
landlord	2667	2583	5250	2917	2533	5450	2792	2558	5350
Relative/friends	1250	1083	2333	0	0	0	625	542	1167
<b>Sub -total (B)</b>	<b>25833</b>	<b>22833</b>	<b>48667</b>	<b>62750</b>	<b>42950</b>	<b>105700</b>	<b>44292</b>	<b>32892</b>	<b>77183</b>
<b>Grand total (A+B)</b>	<b>33717</b>	<b>29433</b>	<b>63150</b>	<b>110667</b>	<b>82433</b>	<b>193100</b>	<b>72192</b>	<b>55933</b>	<b>128125</b>

Figures in the parentheses represent the percent share to the total loan

non-institutional sources in total credit significantly contributing towards the access to institutional credit of this farm category. The value of regression coefficients with respect to farm size and purpose of loan showed that with one unit improvement in these factors, the extent of institutional loan would be increased by ₹103319.04 and ₹144803.39 per farm, respectively. The magnitude of annual household income and share of non-institutional sources has negative correlation with extent of institutional credit. Due to procedural difficulties, the sampled farm families preferred non-institutional sources for short term credit requirement. The results showed that with one unit increased in the share of non-institutional sources, the institutional loan would be declined by ₹2640.20 per farm. However, for long term purposes, they preferred institutional sources of credit. The value of R<sup>2</sup> has clearly indicated that 79.81 per cent of the total variations in the accessibility to institutional sources in terms of magnitude of loan availed was explained by the factors included in the model.

**Reasons for the preference for source of credit by marginal sampled farmers**

The farm families in the rural areas need credit both for productive and unproductive purposes and in this respect; they approach both institutional and non-institutional sources of credit. Non-institutional sources like commission agents, moneylenders etc. provide credit for both productive and unproductive purposes, while institutional sources have been granting loan only for productive purposes. The terms and conditions of loan disbursement like rate of interest, repayment schedule, amount of loan etc also differ significantly between these two sources. Generally, the terms and conditions of institutional sources are fixed and uniform for all, however the term and conditions with respect to non-institutional sources vary from person to person.

Preferences by the sampled farmers approaching institutional sources for meeting their deficit requirement in the study area have been depicted in Table 4. The preferences were measured on the basis of 8 preferential factors viz., access, rate of interest, timeliness, formalities etc. The preference of each factor was assessed on the

basis of the degree of responses which were ranked from 1 to 8 on the basis of the rank given by the respondents. Out of 60 marginal farmers, 23 farmers who have availed institutional credit gave rankings to the 8 factors. By applying Garrett's Ranking test using the ranks given by the respondent's total scores and mean scores were obtained. Ranking of the various factors for preferring institutional credit source was done on the basis of degree of scale measured in terms of ranks from 1 to 8 was gathered from the sampled respondents. Low rate of interest being charged by institutions ranked 1<sup>st</sup>, has emerged the primary reasons of preference on marginal farms for availing institutional credit. It was followed by access (69.74 mean score, 2<sup>nd</sup> rank), credit limit with the institution (57.74), old account or debt (54.04), secrecy (38.57), timeliness (37.35) and so on.

The preferences for non-institutional sources of credit by the marginal sampled farmers are given in Table 5. Out of 60 farmers 43 farmers who availed non-institutional credit gave ranking to the 8 factors. By applying Garret's ranking test using ranks given by the respondents total score and mean score were obtained. It was found that the less formalities was or given the first rank or as a first preference by the marginal farmers in availing non-institutional credit. It was followed by timeliness (65.33 mean score, 2<sup>nd</sup> rank) and easy access (61.26 mean score, 3<sup>rd</sup> rank). Secrecy and personal relation got the least ranks with mean score of 35.49 and 24.33 respectively.

**Reasons for the preference for institutional and non-institutional sources by small farmers**

Preference for approaching institutional sources of credit by the small sampled farmers in the south-western of Punjab has been shown described in Table 6. Out of 60 sampled farmers, 40 farmers who availed institutional credit gave rankings to the 8 factors. By applying Garrett's ranking test using the ranks given by the respondent's total scores and mean scores were obtained. It was found that the rate of interest was given first-rank or as first preference by the small farmers in favour of institutional source of credit. It was followed by credit limit in the institution (57.85) and access (57.75). Similarly, the mean score in favour of old account or

**Table 4: Preference for institutional source of credit by marginal sampled farmers in south western Punjab, 2014-15**

Factor	Rank								Total no of respondents	Total score	Mean score	Rank
	1	2	3	4	5	6	7	8				
Easy access	5	11	6	1	-	-	-	-	23	1550	67.39	2
Low rate of interest	18	5	-	-	-	-	-	-	23	1775	77.17	1
Timeliness	-	1	-	-	4	9	5	4	23	859	37.35	6
Formalities	-	-	-	1	8	3	3	8	23	813	35.35	7
Old accounts or debts	-	1	5	14	2	1	-	-	23	1243	54.04	4
Credit limit	-	5	1-	4	3	1	-	-	23	1328	57.74	3
Secrecy	-	-	1	2	3	1-	3	4	23	887	38.57	5
Personal relations	-	-	1	1	3	-	11	7	23	753	32.74	8

**Table 5: Preference for non-institutional credit of sources by marginal sampled farmers in south western Punjab, 2014-15**

Factor	Rank								Total no of respondents	Total score	Mean score	Rank
	1	2	3	4	5	6	7	8				
Easy access	2	17	10	10	4	–	–	–	43	2634	61.26	3
Low rate of interest	–	–	3	12	6	–	16	6	43	1730	40.23	6
Timeliness	9	12	17	3	2	–	–	–	43	2809	65.33	2
Less formalities	23	8	4	6	2	–	–	–	43	3036	70.61	1
Old accounts or debts	9	6	8	12	7	1	–	–	43	2614	60.79	4
Credit limit	–	–	1	–	20	16	6	–	43	1848	42.98	5
Secrecy	–	–	–	–	–	22	17	4	43	1526	35.49	7
Personal relations	–	–	–	–	2	4	4	33	43	1046	24.33	8

**Table 6: Preference for institutional source of credit by small farmers in south western Punjab, 2014-15**

Factor	Rank								Total no of respondents	Total score	Mean score	Rank
	1	2	3	4	5	6	7	8				
Easy access	2	19	2	4	7	3	3	–	40	2310	57.75	3
Low rate of interest	33	3	–	–	2	–	2	–	40	2999	74.98	1
Timeliness	–	–	7	1	3	9	15	5	40	1559	38.98	7
Less formalities	–	–	4	9	9	7	2	9	40	1673	41.83	6
Old accounts or debts	2	7	10	7	5	–	6	3	40	2090	52.25	4
Credit limit	3	8	12	8	6	2	1	–	40	2314	57.85	2
Secrecy	–	3	5	5	7	16	4	–	40	1863	46.58	5
Personal relations	–	–	–	6	1	3	7	23	40	1192	29.80	8

**Table 7: Preference for non-institutional source of credit by small farmers in south western Punjab, 2014-15**

Factor	Rank								Total no of respondents	Total score	Mean score	Rank
	1	2	3	4	5	6	7	8				
Easy access	5	–	23	3	–	–	–	–	31	1939	62.54	3
Low rate of interest	–	–	–	–	–	–	7	24	31	704	22.70	8
Timeliness	26	3	–	–	2	–	–	–	31	2378	76.70	1
Less formalities	–	26	3	2	–	–	–	–	31	2054	66.25	2
Old accounts or debts	–	2	5	24	–	–	–	–	31	1708	55.09	4
Credit limit	–	–	–	2	19	3	3	4	31	1298	41.87	6
Secrecy	–	–	–	–	10	19	2	–	31	1313	42.35	5
Personal relations	–	–	–	–	–	9	19	3	31	1037	33.45	7

debt, secrecy, timeliness and personal relation came to be 52.25, 46.58, 41.83 and 29.80 as assigned 4<sup>th</sup>, 5<sup>th</sup>, 6<sup>th</sup>, 7<sup>th</sup> and 8<sup>th</sup> ranks, respectively.

In case of non-institutional sources of credit preferences of small farmers have been given in Table 7. Out of the total 60 farmers, 31 farmers who availed non-institutional credit gave rankings to the 8 factors. After the overall ranking and mean score calculated it was found that the timeliness of credit got the maximum mean score (first rank). It was followed by the less formalities (66.26 mean score, 2<sup>nd</sup> rank), easy access (62.55 mean score, 3<sup>rd</sup> rank), old account or debt (55.09 mean score, 4<sup>th</sup> rank) and so on. Personal relations and rate of interest got the least

rank at 7<sup>th</sup> and 8<sup>th</sup>, respectively.

**CONCLUSIONS**

The future of sustainable agricultural growth and food security in India depends on the performance of marginal and small farmers. The credit starvation of these categories symptomizes a vicious circle of low productivity, low income and low investment. Following technological change and greater need for credit by farmers to facilitate their adoption of technology, the question of small farmers' effective access to cost effective and non-exploitative institutional sources of finance is of crucial significance. It was found that factors like farm size, total annual income, location of the

financial institutional agency and purpose of loan were affecting the availability of credit from formal sources of credit in case of sampled farmers. Then, low rate of interest, charged by institutional sources of finance and credit limits formed of borrowers by these agencies emerged as the primary reasons for preferring institutional sources of credit. While lesser formalities, timeliness and easy access were the factors weighing heavily in favour of non-institutional sources of finance. This is an indication towards modifying the procedural norms of formal credit set up to improve the access of farming community especially of resource crunched marginal and small farmers to these.

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## **Improving the Income of Small Scale Rice Producers through Outgrower Scheme in the Volta Region of Ghana**

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### **ABSTRACT**

*The study assessed the impact of Global Agri-Development Outgrower Scheme on the incomes of small scale rice producers in the Volta Region of Ghana. Four hundred and forty (440) producers were selected through the use of purposive and simple random sampling techniques. Propensity Score Matching and descriptive statistics were used for the analysis. The results showed that, small scale rice producers who were part of the outgrower scheme had an average increase of productivity from 0.641bags of rice/acre to 0.689bags/acre compared to those who did not benefit from the project. Furthermore small scale rice producers in the Volta Region who partook in outgrower scheme had increased average annual income between GH¢ 1810 and GH¢ 2608 than those who did not partake in outgrower scheme.*

### **Keywords**

Ghana, GADCO, outgrower scheme, propensity score matching, rice, volta Region,

### **JEL Codes**

D01, M31, O12, Q13

### **INTRODUCTION**

In Ghana, more than 80 percent of all agricultural production is on atomized land holdings of less than one hectare (Sarpong, 2007). Most of these smallholder farmers however are predominantly rural dwellers, with about 90 per cent of farm holdings less than 2 hectares in size (www.mofep.gov.in). The implication of this dominance of smallholders is that no meaningful policy to enhance the development of the agricultural sector can overlook these farmers. Consequently, the country's self-sufficiency in food security crops is threatened; rice production for example stands at about 30 per cent leaving a short fall of 70 per cent. Hence the country currently spends about 450 million dollars annually on rice importation to augment local demand (Anonymous, 2015).

Furthermore, the rice industry in Ghana has seen unprecedented increase in consumption levels over the past decade with significant proportion of consumers switching from consumption of other staples to rice. The Ghanaian rice market however is increasingly dominated by high priced premium rice which is mostly imported.

This captures about 24 percent of national rice consumption and grew at a Compound Annual Growth Rate (CAGR) of 40 per cent from 2006 to 2011 due to rising urbanization and incomes. It is therefore projected that, a percentage change in urban population growth in Ghana will result in 1.6 per cent changes in rice consumption (Kwasi, 2015).

There is therefore a growing import substitution market for varieties of rice that are both aromatic and higher yielding. As a result large private and commercial rice plantations have quickly become the preferred source for aromatic rice. These larger commercial plantations, primarily have better access to the import substitution market channels for rice that they produce or mill, and importantly, the capacity to import and reproduce high yielding seed varieties desired by the market. Consequently, since these large commercial rice plantations cannot meet the growing demand of rice, they have resulted to relying on small scale rice producers to augment their production in the country. Thus, large-scale traders and plantations are willing to buy aromatic rice produced by small-scale farmers with the caveat that the

quality of the milled paddy is equal to what the large plantations are producing for the import substitution market. This is done through technical support, provision of needed inputs and crop protection services on short-term credit to farmers. In this arrangement, also known as outgrower schemes, the large commercial farmers and millers agrees to make payment for delivered paddy directly to a bank or input company providing pre-financing.

Notwithstanding this important step taken by commercial private millers and producers, currently, no research has been undertaken to assess the impact or otherwise of these interventions on the incomes of local small scale rice producers in the country especially in the Volta region where a number of these commercial millers and small scale rice producers are located. This study therefore seeks to assess the impact of one of such rice outgrower schemes, the farmer led outgrower scheme by Global Agri-Development Company (GADCO) in the Volta region of Ghana.

**METHODOLOGY**

**Sources of Data**

Primary data used for this research was obtained through the administration of structured questionnaire to both beneficiaries and non-beneficiaries of GADCO outgrower scheme in the Volta Region of Ghana. Table 1 shows a summary of how the primary data were collected from field. It also shows the type of sampling methods used in collected data.

**Method of Data Analysis**

The fundamental interest in all program evaluation efforts is whether a particular intervention has been effective in accomplishing its primary objectives. The main challenge of a credible impact evaluation is the construction of the counterfactual outcome, that is, what would have happened to beneficiaries in absence of treatment. This comparison allows for the establishment of definitive causality; attributing observed changes in welfare to the program GADCO outgrower scheme, while removing confounding factors. Since this counterfactual outcome is never observed, it has to be estimated using statistical methods such as propensity score matching. Propensity score matching (PSM) uses information from a pool of units that do not participate in

the intervention to identify what would have happened to participating units in the absence of the intervention. By comparing how outcomes differ for beneficiaries relative to observationally similar non-beneficiaries, it is possible to estimate the effects of the intervention.

The general idea of matching is straightforward. Program evaluation faces the impossibility of observing the outcomes of the same unit in both beneficiary conditions at the same time. One feasible solution to this problem is to estimate the counterfactual outcome based on a group of non-beneficiaries and calculate the impact of the intervention as the difference in mean outcomes between groups.

Propensity-score matching requires two main **assumptions** to correctly estimate the impact of a program.

**Assumption 1** (Conditional Independence Assumption or CIA): there is a set X of covariates, observable to the researcher, such that after controlling for these covariates, the potential outcomes are independent of the treatment status:

$$(Y_1, Y_0) \perp D | X \text{-----(1)}$$

The CIA is crucial for correctly identifying the impact of the program, since it ensures that, although beneficiary and non-beneficiary groups differ, these differences may be accounted for in order to reduce the selection bias. This allows the untreated units to be used to construct a counterfactual for the treatment group.

**Assumption 2** (Common Support Condition): for each value of X, there is a positive probability of being both treated and untreated:

$$0 < P(D=1|X) < 1 \text{-----(2)}$$

This second equation implies that the probability of receiving treatment for each value of X lies between 0 and 1. By the rules of probability, this means that the probability of not receiving treatment lies between the same values  $P(D=0|X) = 1 - P(D=1|X)$ . Then, a simple way of interpreting this formula is the following: the proportion of treated and untreated individuals must be greater than zero (positive) for every possible value of X. The second assumption, known as the Common Support or overlap condition, requires the existence of a substantial overlap between the propensity scores of

**Table 1: Summary of sampling size of small scale rice producers**

Strata	Zones	No. of Villages	Sample size (No. of farmers/village)	Sampling Technique
Irrigated	Kpong Irrigation Scheme	5	20	100 Purposive sampling and
	Afefe	5	20	100 Simple random sampling
Rainfed	Ho	5	20	100 Purposive sampling and
	Hohoe	10	14	140 Simple random sampling
Total				440

*NB: Due to missing data only 433 of the 440 data collected were used for the analysis. For the purpose of this study, smallholder farmers were defined as farmers that have 2 hectares or 4.94 acres of land or less in a season*

treated and untreated units. Rosenbaum & Rubin (1983) as quoted by Melkamu & Bannor (2015) indicated that, if this assumption does not hold, it is impossible to construct a counterfactual to estimate the impact of the program. When these two assumptions are satisfied, the treatment assignment is said to be strongly ignorable.

**Estimating the Impact of Outgrower Scheme**

Propensity score is simply the predicted probability from a probit or logit model regression and its goal is to achieve balance on covariates between treated and controls. After propensity scores have been estimated and a matching algorithm has been chosen, the impact of the programme is calculated by just averaging the differences in outcomes between each treated unit and its neighbor. In this study, Stata 12 statistical software programme was used to perform nearest neighbour matching and to generate estimates of the impact of the productive safety net program on household calorie intake.

The impact of a productive safety net program for an individual *i*, noted  $\delta_i$ , is defined as the difference between the potential outcome in case of programme and the potential outcome in absence of programme:

$$\delta_i = Y_{1i} - Y_{0i} \text{-----} (3)$$

In general, an evaluation seeks to estimate the mean impact of the program, obtained by averaging the impact across all the individuals in the population. This parameter is known as Average Treatment Effector

$$ATE: ATE = E(\delta) = E(Y_1 - Y_0) \text{-----} (4)$$

Where E(.) represents the average (or *expected value*).

Another quantity of interest is the Average Treatment Effect on the Treated, or ATT, which measures the impact of the program on those individuals who benefited:

$$ATT = E(Y_1 - Y_0 | D=1) \text{-----} (5)$$

Finally, the Average Treatment Effect on the Untreated (ATU) measures the impact that the program would have had on those who did not participate:

$$ATU = E(Y_1 - Y_0 | D=0) \text{-----} (6)$$

In random assignment, all the characteristics of the individuals are equally distributed between beneficiary and non-beneficiary groups (i.e., the proportions are the

same). On average, the groups will be identical, except for the fact that one of them received the treatment. This implies that:

$$E(Y_0 | D=1) = E(Y_0 | D=0) \text{-----} (7)$$

which allows one to replace the left-hand side (unobservable) with the right-hand side, which is observable, to estimate the ATT. Thus, experimental design ensures that the selection bias term is 0, and therefore, the impact of the program can be estimated as a simple difference between the average outcomes between groups.

$$ATE = E(Y|D=1) - E(Y|D=0) \text{-----} (8)$$

To apply matching to compare a beneficiary with non-beneficiaries who are similar in terms of a set of observed characteristics, predicting the propensity scores for each individual using a probit or a logit model is essential. In this study, we used a probit model to predict the probability that a household participates in outgrower scheme. Propensity scores were estimated by a probit model with the dependent variable coded as 1 for outgrower scheme beneficiaries and 0 for non-beneficiary households, and different household and socio-economic characteristics were included as independent variables. Table 2 gives description of various variable used in probit regression to estimate productivity (bags/acre) from 2013 to 2015 were continues variables where as type of production and gender were during variable.

**RESULTS AND DISCUSSIONS**

Table 3 indicates the number of rice producers in the Volta region of Ghana interviewed. The results revealed that three hundred and one (301) producers who were partakers of the out grower scheme were interviewed. In addition about one hundred and thirty two (132) producers who did not take part in the out grower scheme were interviewed. The result of gender distribution showed an estimated 174 (40.2 per cent) rice producers interviewed were females whereas an estimated value of 259 farmers (59.8 per cent) of sampled rice producers were males. Among the female producers, 71 (40.8 per cent) were non-beneficiaries of GADCO outgrower

**Table 2: Description variables used in the probit regression to estimate propensity score**

Variable	Description	Type	Measurement	Expected sign
<i>Dependent variable</i> (Treatment)	Participation in <i>outgrowerscheme</i>	Dummy	1 if yes, 0 otherwise	
<b>Independent variables</b>				
Education	Number of years of Education	Continuous	Class level	+/-
Age	Total number of years of farmer	Continuous	Number	+/-
Type of Production	Produce under rainfed or irrigation	Dummy	Irrigation=1 Rainfed =0	+
Gender	Sex of the sampled producer	Dummy	1=Female, 0=Male	+/-
Productivity (2013)	Bags of rice harvested per acre	Continuous	Bags/acre	+/-
Productivity (2013)	Bags of rice harvested per acre	Continuous	Bags/acre	+/-
Productivity (2013)	Bags of rice harvested per acre	Continuous	Bags/acre	+/-

**Table 3: Household characteristics of sampled farmers**

Variable	Outgrower scheme beneficiaries		Outgrower scheme non beneficiaries		Total	
	Frequency (N=301)	Percentage (per cent)	Frequency (N=132)	Percentage (per cent)	Frequency (N=433)	Percentage (per cent)
<b>Gender</b>						
Male	198	65.8	61	46.2	259	59.8
Female	103	34.2	71	53.8	174	40.2
<b>Formal educational level</b>						
None	50	16.6	20	15.2	70	16.2
JSS/MSLC	164	54.5	94	71.2	258	59.6
O Level	12	4.0	8	6.1	20	4.6
WASSCE/SSCE	30	10.0	4	3.0	34	7.9
A Level/Professional course	32	10.6	4	3.0	36	8.3
Polytechnic	8	2.7	1	0.8	9	2.1
University	5	1.7	1	0.8	6	1.4
<b>Number of dependants</b>						
1 – 5	192	63.8	77	58.3	269	62.1
6 – 10	96	31.9	52	39.4	148	34.2
Above 10	13	4.3	3	2.3	16	3.7
<b>Age (years)</b>						
20-40	87	28.9	50	37.9	137	31.6
41-60	179	59.5	66	50.0	245	56.6
Above 60	35	11.6	16	12.1	51	11.8
<b>Experience</b>						
1-10	176	58.5	94	71.2	270	62.4
11-20	54	17.9	24	18.2	78	18.0
21-30	39	13.0	9	6.8	48	11.1
31-40	29	9.6	5	3.8	34	7.9
41-50	3	1.0	0	0	3	0.7
<b>Type of production system</b>						
Rainfed	126	41.9	112	84.8	238	55.0
Irrigation	175	58.1	20	15.2	195	45.0

Source: Authors computation based on 2016 field data. NB; MSLC= Middle School Leavers Certificate, JSS= Junior Secondary School, SSCE=Senior Secondary School Certificate Examination, WASSCE= West African Senior School Certificate Examination

scheme whereas about 103 (59.2 per cent) were beneficiaries. Generally, majority of the rice producers in the Volta region were males.

The age distribution revealed ages of producers in the Volta Region of Ghana ranges from 23 to 85 years. The age group with the highest frequency is 41-60 years representing 56.6 percent of the sampled producers. The age group of 20-40 years is the next highest representing 31.6 per cent of farmers interviewed. The mean age group of the sampled farmers is 47 years. The least age group is those above 60 years representing 11.8 per cent. The results indicate majority of the farmers are above their mid age. It also shows that the rice industry does not attract enough young ones notwithstanding the enormous potential and benefits. This suggests the need of encouraging young ones into the rice industry so as to sustain the industry.

Majority of smallholder farmers interviewed

represented by 238 farmers (55.9per cent) depend on rain for their rice production. Among the farmers who undertook rain fed rice production, 126 (52.9 per cent) were outgrower beneficiaries whereas 112 (47.1 per cent) were not outgrower beneficiaries. On the other hand, only twenty (20) farmers who produce under irrigation were non-beneficiaries whereas majority of the producers (175) interviewed were outgrower beneficiaries. The results suggest that, access to irrigation and irrigable land is still one of the major problems for rice producers in the region. If the problem persists, it can affect rice production in coming years, as a result of the erratic rainfall being experienced in the region and the nation as a whole.

The results further indicates the number of years of experience in rice farming among sampled producers ranges from minimum age of 1 to maximum age of 45 years.

Furthermore the highest form of education among outgrower scheme beneficiaries was university education. With regards to university education, five (5) out of the total number of six (6) were project beneficiaries. It clearly indicates that rice producers are highly educated farmers. The high level of education among rice producers can contribute to farm productivity directly by improving the quality of labour, by increasing the ability to adjust to disequilibria, and the propensity to successfully adopt and adapt to innovations. This is because, education is understood to be a most important attribute among others to farm production in a rapidly changing technological or economic environment hence it augurs well for the rice industry in coming years (Bannor & Madhu, 2015).

Figure 1 shows the farmer led outgrower scheme in the Volta region of Ghana undertaken by Global Agri-Development Company (GADCO). To get the best out of the farmers, Global Agri-Development Company (GADCO) which is the commercial miller has employed extension officers who train farmers in Good Agricultural Practices. The company also have demonstration plots close to rice farming areas for practical training. In addition, under the initiative, GADCO signs a written seasonal contract with small holder producers after supplying the farmers depending on farm with inputs such as fertilisers e.g. NPK and Urea; Insecticides e.g. karate; weedicides e.g. rival; rice seeds e.g. Jasmine 85, AGRA, Arise Gold 6,4,4; and fungicides at zero percent (0per cent) interest rate. These compares favourably to other

buyers especially market women who would have charged about fifty percent (50 per cent) interest on any form credit advanced to farmers for production of rice. For example, GADCO supplies a farmer with three (3) 50kg bags of Urea; seven (7) 50kg bags of NPK 15:15:15; 1 litre of insecticide such as karate: 1 litre of rival as weedicide : eighty (80) kg of Jasmine 85 rice at varying prices depending on the market price for that season for a hectare of rice farm at zero interest. In return, farmers avail their harvested wet rice to GADCO at various agreed drying floors close to where a farmer's farm is located. It is important to note that, farmers only cost of marketing under this agreement is associated with carting their rice from farms to the drying floor where the rice will be lifted by GADCO for further processing. Those whose farms are close to the roadside, have the added advantage of their harvested rice being lifted by GADCO. These benefits to farmers have about 95 per cent of them acknowledging the out grower scheme with GADCO is hugely beneficial. After further processing of the paddy, the farmers are informed of the exact weight and their payment is done through a mobile money network known as Tigo cash. According to farmers interviewed, apart from Tigo cash mobile money services being convenient and affordable, payment through Tigo cash has added advantages. These advantages include the reduction of the risk of handling huge amount of money paid to them from paddy sold to the commercial millers and producers. Also, the use of mobile money services for other important financial transactions in the rice value chains has

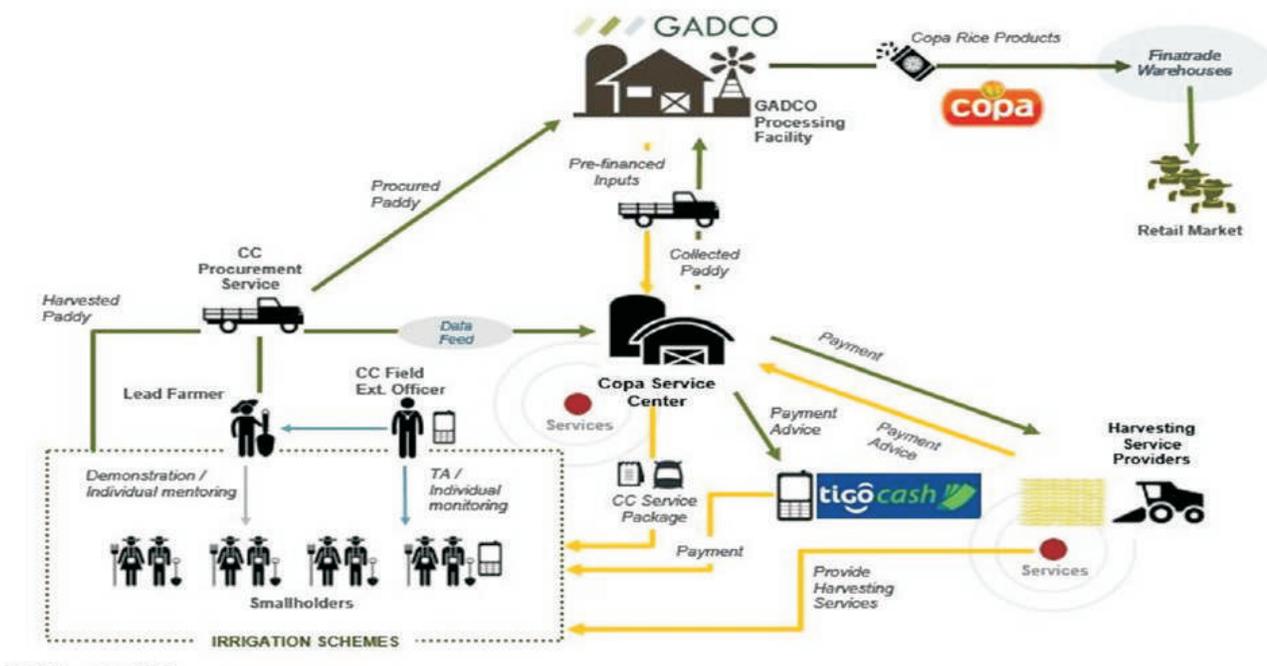


Figure 1: GADCO out grower scheme model in the Volta Region of Ghana

**Table 4: Impact of outgrower scheme on productivity using Propensity Score Matching and Regression**

Estimation method	Bags of rice/acre	Std. Error	T test
ATT nearest neighbour matching	0.641	0.319	2.011
ATT kernel matching	0.689	0.259	2.663
Regression with dummy	3.700	1.483	2.580

Source: Computation based on field data, 2016, NB: Average Treatment Effect on the Treated (ATT).

**Table 5: Probit regression estimates**

Treatment (G-CORP)	Coefficient	Std. Error	z	P> z
Number of years of education	0.043598	0.021109	2.07	0.039**
Age	0.013792	0.006691	2.06	0.039**
Type of production	0.680165	0.250357	2.72	0.007***
Gender	0.048547	0.153524	0.32	0.752
Productivity (2013)	0.002470	0.008748	0.28	0.778
Productivity (2014)	0.007063	0.009611	0.73	0.462
Productivity (2015)	0.008911	0.007977	1.12	0.264
Constant	-1.174084	0.423370	-2.77	0.006***
LR chi2(7) =	70.07			
Prob> chi2 =	0.0000			
Pseudo R2 =	0.1533			
Log likelihood =	-193.49019			

\*\*\* and \*\* Significant at one and five per cent level

brought an improvement in saving culture. In other words, agriculture mobile payments for crop income integrated into the outgrower scheme value is promoting financial inclusion among sampled beneficiary farmers in the Volta Region of Ghana

Using different methods of propensity score matching, the results from table 4 indicate that, there is a difference between the outcome of productivity among G-CORP beneficiaries and non-beneficiaries. It shows that, small scale rice producers who were part of the project, had increase of productivity from 0.641 bags of rice/acre to 0.689 bags/acre compared to those who did not benefit from the project.

The output above show a regression table—these are the regression estimates from the probit model that was used

**Table 7: Impact of G-CORP on annual income using propensity score matching and regression**

Estimation Method	Annual income	Std. Error	T test
ATT nearest neighbour matching	1685.218	594.176	2.836
ATT radius matching	2607.657	514.504	5.068
ATT kernel matching	1810.139	514.342	3.519
Regression with dummy	94.3	524.252	0.180

Source: Computation based on field data, 2016, NB: Average Treatment Effect on the Treated (ATT), 1\$=GH¢ 3.8

to calculate the propensity scores. After this, it presents the estimates of the average treatment effect. As indicated in table 5, number years of education, age and type of production system undertaken by a farmer significantly influenced household participation in outgrower scheme in the study area. After the propensity scores were estimated, a nearest neighbor matching estimator was used to compute the average impact of the outgrower scheme among beneficiaries and non-beneficiaries households.

Balance checking was done to check balancing status before trusting the ATT estimation on impact of outgrower scheme on small holder rice farmers' annual income in the study area. The result shows, after matching, most of the differences are no longer statistically significant; suggesting that matching helps to reduce the bias associated with observable characteristics and it implies a good balancing of the covariates.

The average treatment effect on the treated (ATT) is useful to explicitly evaluate the effects on those for whom the G-CORP is actually intended. From Table 7, after matching treated (outgrower beneficiaries) and control small holder rice farmers (outgrower non beneficiaries), the effects of project has resulted in higher annual incomes or earnings by about GH¢ 1810 to GH¢ 2608. In other words, small scale rice producers in the Volta Region who partook in the G-CORP project had increased annual income between GH¢ 1810 and GH¢ 2608 than those who did not partake in the project.

## CONCLUSIONS AND RECOMMENDATIONS

**Table 6: Balance checking after matching**

Variable	Mean			T test	
	Treated	Control	Per cent Bias	t	p> t
Number of years of education	8.8109	8.0714	20.0	0.40	0.686
Age	46.584	46.845	-2.2	0.69	0.489
Type of production	0.52101	0.54202	-4.8	14.00	0.000
Gender	0.63445	0.58824	9.4	-1.52	0.129
Productivity (2013)	24.762	26.684	-11.8	-1.82	0.070
Productivity (2014)	26.315	26.092	1.3	-1.40	0.164
Productivity (2015)	68.848	23.369	11.3	10.94	0.000

The study has revealed that, outgrower schemes significantly affect income and productivity of small scale farmers in the Volta region of Ghana. In the context of policy implications, first the Government of Ghana should encourage outgrower schemes between large scale commercial millers and small scale farmers in the country. Secondly, other stakeholders such as inputs dealers, NGOs, Municipal, Metropolitan and District Assemblies should partner with commercial millers to provide services like technical capacity building, supply of inputs and other services to support rice outgrower schemes in the Volta Region of Ghana. Lastly, Government should lobby large scale investors in rice production into the country through such outgrower schemes to support small and medium scale rice producers in Ghana.

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## Impact of IWMP on Land Use and Cropping Pattern in Central India

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### ABSTRACT

The present study has been undertaken to analyze changes occurred in irrigation potential and determine the impact of Integrated Watershed Management Programme (IWMP-Watershed Development) on land use and cropping pattern in Madhya Pradesh. All the 33 watershed development areas 32 districts under the project have been selected in the State. 10 per cent or minimum 10 beneficiaries (1285) were selected randomly under these watershed development areas for the study. It was observed from the study that irrigation by all the sources was found to be increased by 17.36 per cent in the current year (0.47 ha) as compared to base year (0.40 ha) in an average farmer's field with the implementation of the project in the State. The size of holding, net cultivated area of an average farmer was also found to be increased by 2.14 per cent and 4.88 per cent respectively during the period under study. The area under uncultivated waste land, non-agriculture and grazing land, current fallow and old fallow was found to be decreased by 28.57, 14.71, 14.29 and 14.06 per cent respectively. The cropping intensity of an average farm was found to be increased by 11 per cent from 151 (Base year) to 162 per cent (current year). The area under rabi crops (7.51 per cent) increased more compared to kharif crops (7.34 per cent). The result of increased in area and productivity of the crops the production of crops were also found to be increased from 3.47 (Mustard) to 118.98 (Lentil) per cent in the current year as compared to the base year.

### Keywords

Cropping pattern, irrigation, IWMP, land use, productivity

### JEL Codes

O32, Q01, Q15, Q24, Q25, R14

### INTRODUCTION

The watershed programme endeavour to improve, optimize and sustain production and productivity of all categories of land. The specific object of the programme include, promotion of in situ soil and water conservation, optimum use of land to minimize risk in rainfed farming, increase productivity of land and provide higher returns to the farmers on a sustainable basis through adoption of better technology, cropping pattern and diversification of sources of income, proper management to non-arable land, improvement of ground water recharge and production on food, fodder, fuel, fiber, fruits and timber to maintain the ecological balance (Ramanna, 1991). Most of the watershed projects in India are implemented with the twin objectives of soil and water conservation and enhancing the livelihood of rural poor (Sharma & Scott, 2005).

The Watershed Development Programmes (WDPs) have been accorded high priority in India's development plans (Singh *et al.*, 1991). These programmes have been

initiated in India to improve and sustain productivity and the production potential of the dry and semi arid regions of the country through the adoption of appropriate production and conservation techniques (Ninan and Lakshminathamma, 2001). Ministry of Rural Development, Government of India had started watershed management programme in the year 1994 under Drought Prone Area Programme (DPAP) and Integrated Wasteland Development Programme (IWDP). Considering its importance, Government of Madhya Pradesh, Panchayat and Rural Development Department had also constituted Rajiv Gandhi Mission for Watershed Management (RGMWM) in August, 1994 to plan and implement the watershed projects in mission mode with the aim of reducing the vulnerability to droughts, improving the incomes and livelihood of people and also providing short-term employment opportunities. Rainfed agriculture added about 44 per cent of total food production and 75 per cent of oilseeds and pulses production in India (Rambabu, 1987).

The main objectives of the IWMP (Watershed Development) is to enhance agricultural productivity by increasing in situ moisture conservation and protective irrigation for socio economic development of rural people (Joshi *et al.*, 2004). Taking this in view the country wide watershed development projects sectioned by the government of India during 1995–1998, and had been taken up by ministry of rural development. The benefits have been seen in the forms of, enhanced quality of the water harvesting structures, reduction in the soil erosion, increase in the ground water level, change in the land use land cover pattern, cropping intensification. Although these benefits are seems to be valuable for the society it may not necessarily virtuous for the environment. Keeping these views in mind the present study has been undertaken in all the watershed areas (33) to analyze change in irrigation potential and determine the impact of watershed mission on land use and cropping pattern in Madhya Pradesh.

**METHODOLOGY**

The study based on the primary data. The data were collected through pre-tested interview schedule from the respondents.

These primary data have been classified into two parts i.e. before and after inception of irrigation potential and productivity component in the watershed approach in the area under study.

All the 33 watershed development areas from 32

districts have been selected in the State. 10 per cent or minimum 10 beneficiaries from each category were selected randomly under the watershed development area. Thus, 1285 beneficiaries have been selected for the study covers 18.18 per cent of beneficiaries and more than 30 per cent of total Watershed Command Area of Madhya Pradesh (Table 1). To analyze the impact of the study year 2009–10 and 2014–15 were taken as the base and the current year for the study.

**RESULTS AND DISCUSSION**

The change occurred potential of irrigated water from different sources and its impact on Land Use and Cropping Pattern have been analyzed for the study.

**Irrigated Area**

The changes occurred in irrigated area, depth of water table and number of irrigations was observed and presented in Table 2.

An overall area under irrigation by all the sources was found to be increased by 17.36 per cent in the current year (0.47 ha) as compared to base year (0.40 ha) with the implementation of IWMP in the State. The maximum increase in area under irrigation was from wells (17.86 per cent) followed by tube-wells (17.54 per cent) and ponds (12.90 per cent).

The depth of water table was found to be decreased remarkably in the State after implementation of the project. Amongst different sources of irrigation, the maximum decrease of 22.73 per cent from (1.10 to 0.85

**Table 1: Number of selected beneficiaries in different size of farms**

Agro-Climatic Zone	Selected No of IWMP	Marginal	Small	Medium	Large	Total
Vindhya Plateau	6	85	57	48	21	211
Central Narmada Valley	1	10	10	10	9	39
Jhabua Hills	2	22	23	18	3	66
Kymore Plateau	6	90	64	55	46	255
Nimar Plains	2	20	20	20	1	61
Northern Hill of Chhattisgarh	1	10	10	10	10	40
Satpura Hills	2	20	20	20	14	74
Bundelkhand region	3	42	45	33	20	140
Gird Region	3	43	33	24	20	120
Malwa Plateau	7	89	80	71	39	279
<b>Madhya Pradesh</b>	<b>33</b>	<b>431</b>	<b>362</b>	<b>309</b>	<b>183</b>	<b>1285</b>

**Table 2: Changes occurred in irrigated area in Madhya Pradesh**

Sources	Irrigated area (ha)			Depth of water table (M)			Number of irrigations		
	Base year	Current year	Per cent change	Base year	Current year	Per cent change	Base year	Current year	Per cent change
Ponds	0.08	0.09	12.50	1.10	0.85	-22.73/29.41	0.7	0.8	14.29
Tube-wells	0.57	0.67	17.54	30.73	28.48	-7.32/7.90	2.3	3.3	43.48
Wells	0.56	0.66	17.86	11.98	9.43	-21.29/27.04	2.8	3.8	35.71
Overall	0.40	0.47	17.36	14.6	12.9	-11.53/13.18	1.9	2.6	36.21

meter) in depth of water table was found in case of ponds followed by wells (21.29 per cent) from 11.98 to 9.43 meter and tube-wells (7.32 per cent) from 30.73 to 28.48 meter in current year as compared to base year. The maximum increase in number of irrigations were found in case of tube wells (43.48 per cent) from 2.3 to 3.3 followed by wells (35.71 per cent) from 2.8 to 3.8 and ponds (14.29 per cent) from 0.7 to 0.8 in current year as compared to the base year.

**Land Utilization**

The size of holding of an average farmer was also found to be increased by 2.14 per cent in the current year as compared to the base year. The increase in size of holding might be due to extra land could have been purchased by the farmers or inclusion of leased in land in the current year (Table 3). The cultivated area was also found to be increased by 4.88 per cent, that is, from 2.31 (Base year) to 2.42 ha (current year). The area under uncultivated waste land, non-agriculture and grazing land, current fallow and old fallow was found to be decreased by 28.57, 14.71, 14.29 and 14.06 per cent respectively due to implementation of the project in the State.

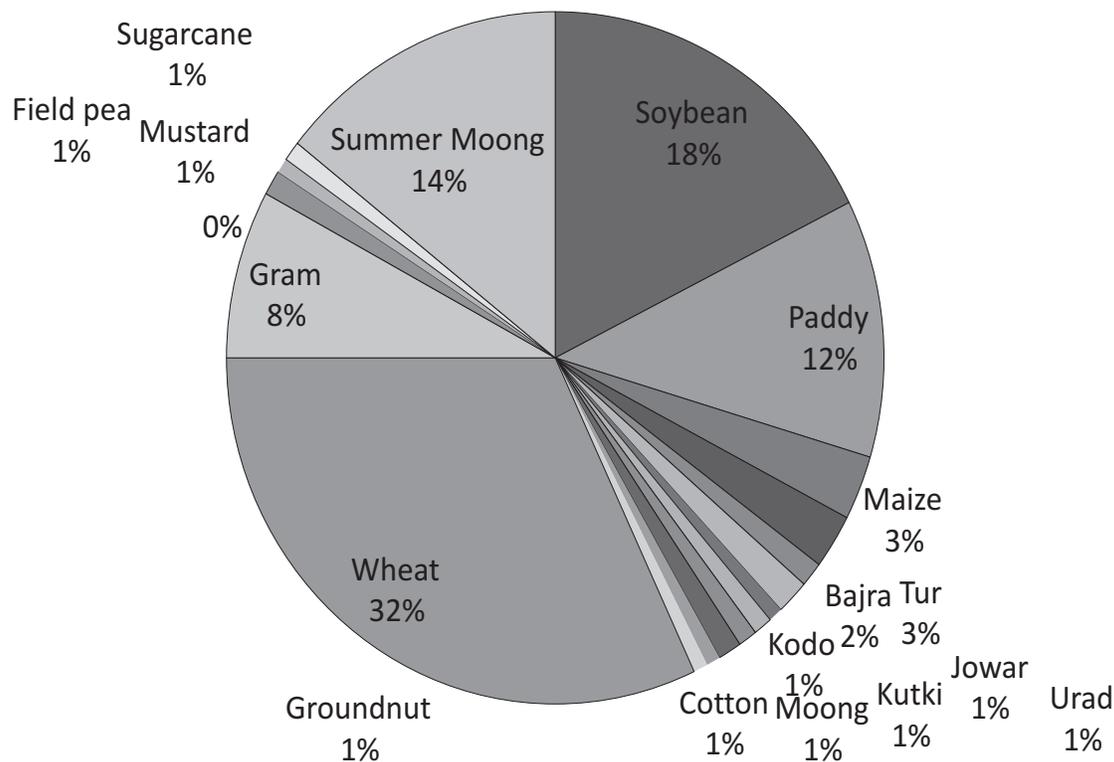
**Cropping Pattern**

The changes occurred in cropping pattern as well as cropping intensity has also been observed for various size of farm and presented in the Table 3. It is observed from the data that an average farmer was found to be devoted in

**Table 3: Changes occurred in land utilization pattern in Madhya Pradesh**

Particular	(Ha)		
	Base year	Current year	Per cent change
Size of holding	2.69	2.74	2.14
Cultivated land	2.31	2.42	4.88
Non-agri and grazing land	0.09	0.07	-14.71
Graging and other	0.07	0.05	-28.57
Current fallow	0.07	0.06	-14.29
Old fallow	0.16	0.14	-14.06

3.86 ha of land in cultivation of crops in the year 2014-15. Wheat (32 per cent) followed by soybean (18 per cent), summer moong (14 per cent), paddy (12 per cent), gram (8 per cent), maize (3 per cent) and tur (3 per cent) were found to be major crops of th Madhya Pradesh. Jwar (1 per cent), bajra (1 per cent), kodo (1 per cent), kutki (1 per cent), moong (1 per cent), field pea (1 per cent), cotton (1 per cent), urd (1 per cent), mustard (1 per cent), groundnut (1 per cent), and sugarcane (1 per cent) were also been found to be growth by the farmers (Figure 1). Cropping intensity of an average farm was found to be increased by 11 per cent from 151 (Base year) to 162 per cent (current year) during the period under study. The net and gross



**Figures 1: Cropping pattern of an average farmer**

**Table 4: Changes occurred in area, production and productivity in Madhya Pradesh**

Crops	Area (ha)			Production(q)			Productivity kg/ha		
	Base year	Current year	Per cent change	Base year	Current year	Per cent change	Base year	Current year	Per cent change
Soybean	0.71	0.76	7.04	5.28	6.00	13.66	7.44	7.90	6.14
Paddy	0.48	0.52	8.33	9.51	11.39	19.76	19.82	21.91	10.56
Maize	0.11	0.13	18.18	1.59	2.01	26.35	14.46	15.46	6.90
Tur	0.10	0.11	10.00	0.71	0.86	21.05	7.07	7.78	10.01
Jowar	0.05	0.05	0.00	0.66	0.69	5.64	13.13	13.87	5.61
Bajra	0.09	0.07	-22.22	0.90	0.75	-15.82	9.96	10.78	8.19
Urad	0.03	0.03	0.00	0.09	0.09	8.07	2.85	3.08	8.15
Kodo	0.03	0.04	33.33	0.14	0.20	41.65	4.81	5.11	6.27
Kutki	0.05	0.04	-20.00	0.28	0.24	-15.86	5.60	5.89	5.30
Moong	0.03	0.05	66.67	0.11	0.22	102.80	3.69	4.49	21.60
Groundnut	0.02	0.03	50.00	0.37	0.59	61.51	18.37	19.78	7.68
Cotton	0.02	0.03	50.00	0.26	0.40	55.09	12.96	13.40	3.36
<b>Total Kharif</b>	<b>1.77</b>	<b>1.90</b>	<b>7.34</b>						
Wheat	1.21	1.38	14.05	28.64	35.34	23.40	23.67	25.61	8.19
Gram	0.41	0.34	-17.07	3.76	3.36	-10.46	9.16	9.89	7.94
Lentil	0.01	0.02	100.00	0.05	0.12	118.98	5.48	6.00	9.57
Field pea	0.04	0.05	25.00	0.24	0.31	28.76	5.99	6.17	3.10
Mustard	0.03	0.03	0.00	0.21	0.21	3.47	6.92	7.16	3.37
Sugarcane	0.03	0.04	33.33	0.97	1.39	43.28	32.29	34.70	7.49
<b>Total Rabi</b>	<b>1.73</b>	<b>1.86</b>	<b>7.51</b>						
Summer Moong	0.37	0.62	67.57	0.16	0.25	57.56	3.97	4.17	5.04
GCA	3.48	3.86	11.15						
NCA	2.31	2.42	4.88						
CI (per cent)	151	162	11.00						

cropped area was also found to be increased by 4.88 and 11.15 per cent respectively.

The area under rabi crops (7.51 per cent) showed more percentage increase as compared to kharif crops (7.34 per cent) in current year compared to base year. Amongst different kharif crops the area of all the crops found to be increased except till (-20.00 per cent), bajra (-22.22 per cent) and kutki (-20.00 per cent). Amongst rabi crops the area of all the crops found to be increased from 14.05 per cent (Wheat) to 100 per cent (Lentil) except gram (-17.07 per cent).

The area of summer moong was also found to be increased by 67.67 per cent in the current year as compared to the base year during the period under study. The result of increased in area and productivity of the crops the production was also found to be increased from 3.47 (Mustard) to 118.98 (Lentil) per cent at overall level in the current year as compared to the base year. At overall level the change in production of lentil was found to be maximum (118.98 per cent) followed by moong (102.80 per cent), cotton (61.51 per cent), Zaid Moong (57.56 per cent), cotton (55.09 per cent), sugarcane (43.28 per cent), kodo (41.65 per cent), field pea (28.76 per cent), maize (26.35 per cent), wheat (23.40 per cent), arhar (21.05 per cent), paddy (19.76 per cent), soybean (13.666 per cent),

urad (8.07 per cent), jowar (5.64 per cent) and mustard (3.47 per cent), while the production of kutki, bajra, gram, and sesame was found to be decreased by 15.86, 15.82, 10.46 and 10.32 per cent respectively in the current year over the base year. The maximum increase in productivity of moong, sesamum, paddy and arhar was found to be 1.60, 12.06, 10.56 and 10.01 per cent respectively while, amongst the remaining crops grown in the region the change in productivity ranged between 3.10 (Field Pea) to 9.57 (Lentil) per cent at overall level of different size of holding (Table 4).

#### CONCLUSIONS

It is clear from the above findings that not only area under irrigation through all the sources of irrigation was found to be increased due to remarkable decrease in depth of water table almost in all the sources, but the number of irrigations by all the resources and area under irrigation were also increased across different size of holdings. Although, the yield of crop were found to be increased except jawar and maize with the successful implementation of watershed approach in the area under study but still there is found yield gap in the actual farmer yield and potential yield of crop as per the recommended package of practices (Kumar *et al.*, 2016). Hence affords should be made to find out the constraints which came

across increase potential yield of the crops in the area under study.

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## Impact of Growing E-Commerce on Indian Farmers

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### ABSTRACT

In spite of the fact, agriculture is the largest livelihood provider in our country, the small farmers gains are not enough compared to the efforts put in and agriculture cost inputs which can affect the agricultural productivity and food security of the nation. As the Internet continues to become more popular, with the application of e-commerce, many transactions through the supply chain are eliminated or simplified. In this way, transaction costs are drastically reduced or even eliminated. Reports show that farmers are slightly behind the general population in adoption of e-commerce but adopters are getting astonishing benefits.

### Keywords

E-commerce, e-tailing, farmers' income, internet, information technologies

### JEL Codes

L10, L81, M21, Q12, Q13, Q19

### INTRODUCTION

While e-commerce is a very recent phenomenon of the late 1990s, it already has a brief, churning history. The e-commerce sector has seen unprecedented growth in 2014. The growth driven by rapid technology adoption led by the increasing use of devices such as smart phones and tablets, and access to the internet through broadband, 3G, etc., which led to an increased online consumer base. E-commerce is a process of modern agri business which addresses the need of organizations, intermediaries and farmers to ease the agri business reduce cost and improve the quality services while increasing the speed and timely delivery. E-commerce is a paperless and supports to the environment. Cathle *et al.* (2009) mentioned e-commerce has many differences with many advantages over traditional commerce system (Table 1).

#### Features of e-commerce

There is a rising awareness among the agriculture community in India about the opportunities offered by e-commerce. Ease of internet access and navigation are the critical factors that will result in rapid adoption of e-commerce. Some important features of e-commerce are mentioned below:

- Omnipresence: It is available just about everywhere, at all times.
- Global reach

- Worldwide standards
- Multidimensional communication
- Personalization and customization
- Inventory management
- 24x7 Service availability

#### Different types of e-commerce

- Business to Consumer (B2C)
- Business to Business (B2B)
- Business to Government (B2G)
- Consumer to Consumer (C2C)
- Consumer to Business (C2B)
- Peer to Peer (P2P)
- Mobile commerce or m-commerce

#### THE IMPACT OF E-COMMERCE

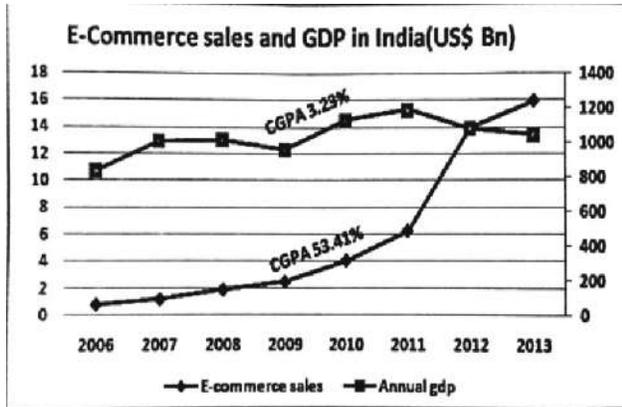
Figure 1 shows the growing trend of Gross Domestic Production (GDP) with 3.23 per cent compound annual growth rate. On other hand, e-commerce in India is also showing an increasing trend with 53.41 per cent compound annual growth rate, which is higher and was almost double in the year 2012, which further indicates a boom period because of rise in the number of service providers of e-commerce.

#### Impact of e-commerce on economic growth

- Reducing cost of information and communication technologies
- Firms' cost structure

**Table 1: Difference between traditional commerce and e-commerce**

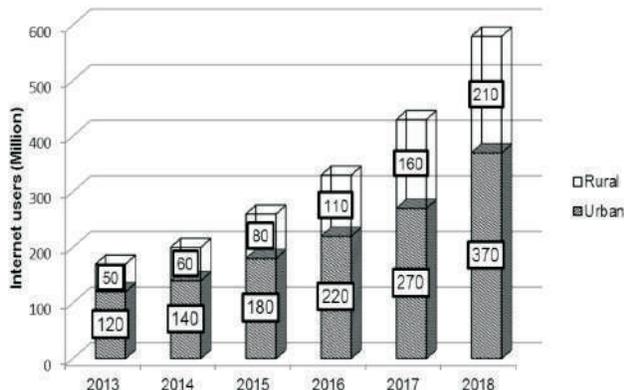
Traditional commerce	E-Commerce
Large dependence on information exchange from person to person.	Little dependency
Manual intervention	Electronic or automatic system intervention
Difficult to establish and maintain standards	Easily established and maintained
Communication depends upon individual skills	No human intervention
Difficult to provide all information at one place	Very easy
Product must be available at multiple store locations to maximize purchasing opportunities.	Multiple inventory ownership options, just-in-time and a hybrid of two.



**Figure 1: E-commerce sales and GDP in India**

- c) Consumer support and hand holding
- d) Purchase order and procurement
- e) Firms' inventories and distribution
- f) Changing the supply chain
- g) Online payment and prices

According to a recent India@Digital.Bharat (The Boston Consulting Group and Internet and Mobile Association of India) report, with the growing internet users, this will comprise 580 million users by 2018 (Figure 2). Online shopping can grow more than hundred-fold in the next 9 years, to reach \$ 76 billion by 2021. Indian internet users have played a significant role in growing the business markets. The Internet is being used as an instrument for: explore new markets, maintain



**Figure 2: India's internet population**

consumer relationships, improving cost efficiency, and delivering customized products and services.

As the Table 2 shows, internet by 2018 will be more mature and mobile will be more predominant. Rural users, as a percentage of the Internet population, will rise from 29 percent in 2013 to between 40 and 50 percent in 2018.

This sector will open up significant growth opportunities for manufacturers and service providers, which can leverage the wider, targeted and more cost optimal online channels effectively to cater to internet customer base in the villages. India will likely see the golden period of the Internet sector between 2013 to 2018 with incredible growth opportunities and secular growth adoption for E-commerce, internet advertising, social media, search, online content, and services relating to E-commerce and internet advertising. Boateng *et al.* (2008) conducted research and found a few common critical success factors for e-commerce. These authors stated that for e-commerce initiatives to succeed, the first and foremost condition must be customer readiness, or propensity for e-commerce.

**Impact on Agriculture**

The open access of the Internet, declining information technology costs, and high volume have resulted in progressive steps forward for the entire marketing system. Parallel changes in the structure of agriculture have also contributed to the popularity of the current generation of information technology. Chief among the changes is the need for closer coordination of the supply chain –both upstream and downstream from the producer –and stretching from seed, fertilizers, and machinery suppliers, to food processors and retailers. Thus, technologies like electronic commerce have forced new relationships between and among the buyers of agribusiness to form a complex web interaction (Ehmake *et al.*, 2001).

Various studies show that there is much about the potential success of e-commerce in agriculture. Common agribusiness business-to-business transactions such as buying, selling, trading, delivering and contracting seem to be natural targets for conversion to e-commerce (Shapiro and Varian, 1999). Many theoretical benefits of e-commerce in agriculture have been identified such as:

**Table 2: Description of internet users in India**

	2013	2018
Older	60 per cent under 25 years old	54 per cent over 25 years old
Rural	29 per cent rural	40–50 per cent rural
Gender Balance	2.9 men online for every woman online	1.9 men online for every woman online
Mobile	60–70 per cent of users	70–80 per cent of users

Source: <http://techcircle.vccircle.com/2013/02/01/2013-ecommerceindia-internet-outlook>

(1) promotion of information flow, market transparency and price discovery; (2) facilitation of industry coordination (Nicolaisen, 2001); and (3) reduction or elimination of transaction costs (Porter, 2001; Thompson, 1996). Internet based e-commerce also offers tremendous opportunities to create collaborative marketplaces in a low-cost, effective way (Nicolaisen, 2001). E-commerce can also change the situation of hard bargains caused by scattered farmers and lack of information. At the same time, the fast and convenient electronic bargain manner can accelerate the circulation of commodities, lessen the risk, and increase the competition of agricultural products in the international market. These theoretical benefits appear to be undisputed. However, they have yet to materialise into profitability and productivity (Cathle and Grazi, 2009).

Goldman (2000) discussed the general barriers cited by business to Internet based e-commerce adoption and explained that these barriers also apply to agribusiness. They include: (1) unclear return on investment; (2) lack of budget; (3) lack of stakeholders support and (4) complicated technology. Added to these, there may be factors slowing down e-commerce adoption in agriculture. No doubt e-commerce has huge opportunities for the agricultural sector, but adoption of e-commerce in agriculture is not an easy task. And at this point in time the impact of e-commerce on farms, agribusiness firms, markets, and rural communities is not very clear. Are there only winners or are losers too? If so, who are they? What will governments do, will they be with or against e-commerce in agriculture? Since e-commerce is still evolving, it is too early to be able to obtain a definitive answer (Mueller, 2000). An inspection of current practices; however, suggests that success of e-commerce in agribusiness is undeniable. Factors specific to agriculture will create additional challenges, which must be overcome before success can be attained. The ability of each player to work through these challenges will determine the speed of implication of e-commerce in agriculture.

#### **Impact on income of farmers**

Prime Minister Shri Narendra Modi launched a new mobile APP-Kisan Suvidha. Given that India has the world's second largest smart phone market, with 87 million rural mobile Internet users, and agriculture is the mainstay of Indian economy, with more than 60 per cent of the workforce employed in it, it is presumed that this

app is likely to have many takers and is poised to change the face of Indian agriculture. However, there are some worrying factors. First, a smart phone is required to operate this app. Secondly, at present, the information is available only in Hindi and English. Both these factors are currently proving detrimental to the large-scale impact this app set out to create. According to IAMAI, the Active Internet User (AIU) base in rural India was 6.7 per cent of the overall rural population of 905 million and accounted for 61 million as per verified 2014 data, which is projected to be 109 million by mid-2016. However most of these users use the same for messaging service WhatsApp only. Farm advisories need to be customized and given in a method that farmers can understand and execute on their fields. Many organizations and start-ups in the agriculture domain are working towards addressing the issues faced by Indian agriculture. Government of India is proactively working towards addressing the unmet needs of the farmers across the agri-value chain through multiple initiatives like Soil Health card scheme, Paramparagat Krishi Vikas Yojana, National e-Governance Plan (NeGP), m-Kisan, etc. (TATA, 2016).

#### **Case study of Ekgaon Technologies**

Ekgaon Technologies tackles the issue of agriculture at two-levels – first, farmers join Ekgaon's 'One Village One World Network,' in which they have access to farm advisory and other services through their mobile phone – all of which helps in increased and better productivity, while reducing total cost of cultivation. Secondly, the organisation has established ekgaon.com, a 'direct from farm' platform that connects the farmers to customers who are looking for healthy, natural and organic food. Ekgaon's delivery model is based on 'when I need', which essentially means hand-holding the farmers during the cropping season, with smart advisory that is aimed at increasing farm productive and reducing cultivation costs. For ₹ 150 per cropping season, Ekgaon's farm advisory service for small farmers, provides customised information on soil and its nutrient management, crop and weather conditions, disease alerts and market prices, as well as critical information on how much water will be released by the local authorities and when it would reach their respective fields. All the information is delivered via SMS in the local language as well as an outbound-call on the farmer's phone at planned intervals as per each farmer's crop cycle. When a farmer confirms the usage of advice by sending SMS or pressing buttons by calling the

Ekgaon number, the company understands the trend of best practices and continually refines them. Last year, Ekgaon conducted an impact survey and the results have been exciting. Survey included a sample of 10,000 farmers and the average production increase per farmer went up from 12.05 quintal per acre to 24.91 quintal per acre. Last year, it started an online platform to sell the farmers' produce at the right prices, under the brand 'Ekgaon'. In just a year, the platform has amassed over 5,000 customers of whom 50 percent are repeat customers. Over 130 different products are sold – rice, flax seed, pulses and millets, spices, sugar etc. All products cater to a healthy food brand philosophy, for example it sells Palm sugar and Jaggery and not white sugar, which is not good for health. The farmers' income, as a result of both the mobile-based advisory services as well as the marketplace, has seen an average increase of ₹ 8,500 per month, or 67 percent. Ekgaon expects to double the farm income in next few years and ensure the monthly bonus credited to bank account of its network farmers.

#### **CONCLUSIONS**

This is the first of its kind in India, in terms of using Internet Adoption, which still is a complex issue for application in farming practices in India, to say the least. Hence, this study is unique and proposes practical implications for agricultural sector which is in dire need of technology up gradation and application at all levels to face the global crisis in terms of production and distribution of this scarce resource. A key reason why e-commerce is growing so quickly is its significant impact on ease of business and its costs and productivity.

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## **Farm Women Empowerment through Income Generating Activities: A study of Bikaner District of Rajasthan**

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### **ABSTRACT**

*The agricultural scenario in rural India presents a very intricate picture of role of women and activities related to complete farm production. In fact, rural women and agriculture seems to be synonymous terms. Many experts on evolution opined that it was the women who are responsible for settled agriculture. Farming is a family enterprise in which both men and women work shoulder to shoulder in the fields. Women's participation in agriculture production includes a variety of tasks ranging from preparatory tillage to the harvesting and post harvesting tasks. Almost 70-80 per cent of the agricultural operations are done by women. Empowerment of the farm women in income generating activities is a current need of the time in an agrarian country like, India. Addressing these issues how Empowerment of farm women doubling the income activities are discussed in the paper.*

### **Keywords**

Family distribution, farm women education, income generation, socio-economic status, women participation, women empowerment

### **JEL Codes**

B26, B54, C39, C81, C83, C88, D31, D63, D64, D78, E21, H53, J16, J31

### **INTRODUCTION**

Rural women constitute the most important productive work force in the Indian economy. About 18 per cent of the economically active women are engaged in agriculture sector in the country. In dairy and animal husbandry, women far outnumber the men and this sector of agriculture is wholly dependent upon the women workforce (Dangol, 2010). Almost all the rural women in India some senses as almost all of these are directly or indirectly engaged in some agricultural activity such as agriculture, labor, working in the family, farm land holding, dairying and animal husbandry, etc. As the majority of the agricultural work force in the country comprises of the women, their role in the decision making in different agricultural activities needs to be properly looked into (Bhandari, 2014). Rural women in our country share abundant responsibilities and perform a wide spectrum of duties in running the family, maintaining the households, attending to farm labor, tending domestic animals and extending a helping hand in rural artisanship and handicrafts (Naik *et al.*, 2014). In spite of discharging all these duties their involvement in

the decision making process specially related to money matters is low. Women play an important role in initiation, control and supervision of farm production, horticulture and livestock in productive work (Census, 2011). Despite women's critical contribution to the family income through productive activities, no recognition is given to them as an important contributor and their contribution is not recorded (Godara *et al.*, 2014). The overview of some of the studies conducted in India showed considerable variation in women's involvement in farming in different parts of the country especially in rural societies. The states like Punjab and Haryana show positive role of women in farming in most of the families. In rural families, type and size of the family, caste, size of land holding, socioeconomic status of the families, education level of rural women, their employment status and rational position affects her involvement in decision making (Chayal *et al.*, 2013).. Besides this, women's role becomes negligible where the decisions, increase in complexity in rural families due to the illiteracy of women (Hussain and Baṁlādeśa, 1988). Since, women play a key role in production, they should be the first person to take

decisions and make plans.

More specifically the objectives of study were:

- a. to assess the socioeconomic status of farm women,
- b. to study the participation of farm women in agriculture and non-agricultural related activities, and
- c. to study the impact of income generation on women empowerment

### MATERIALS AND METHODS

The study was conducted in Bikaner district of Rajasthan to assess the women empowerment through participation of women in income generating activities in Bikaner district of Rajasthan. This was a descriptive research study based on primary as well as on secondary data. The study was an attempt to analyze the women empowerment in income generation activities. The methodology for the collection of primary data Pre-structured and pre-tested schedule was prepared and the personal interview of farm women was taken. The schedule was contained both open-ended and closed-ended questions. Primary data was collected from field survey through filled in questionnaire and direct interview method and their impact on livelihood and their socio-economic conditions in the various villages of the district. The secondary data sources were the web portals and different magazines, journals, etc. Sample size: 90 farm women. 3 villages were selected out of which 30 women per village were selected through Purposive Sampling. 3 villages were selected. 1 village from un-irrigated area and 2 villages from irrigated area were taken by Canal and Tube well area respectively. The respondents from 3 villages, 30 women from each village was selected by judgmental sampling.

#### Objective 1: To assess the socioeconomic status of farm women

- For studying the socio economic status of farm women, data regarding age, caste, education, number of family members, land holdings, crops grown and other farm resources etc. were collected. Data was also being presented through graphs and chart.

#### Objective 2: To study the participation of farm women in agriculture and non-agricultural related activities

- For achieving this objective, data for total working hours of women in the family was collected regarding all the income generating activities. The different activities for income generation were also listed to know the share of

women. The different activities related to farming were also listed to assess the participation of farm women.

#### Objective 3: To study the impact of income generation on women empowerment

- To analysis the impact of income generation on women empowerment, correlation analysis was attempted.

$$r = \frac{n (\sum xy) - (\sum x) (\sum y)}{[n \sum x^2 - (\sum x)^2] [n \sum y^2 - (\sum y)^2]}$$

Where,

R= Simple correlation between income generation (y) and socio economic characteristics (xis)

Y= Share of income generated by women

xis= Socio-economic characteristics

x<sub>1</sub>= Age

x<sub>2</sub>= Caste

x<sub>3</sub>= Education

x<sub>4</sub>= Occupation

x<sub>5</sub>= Size of land

x<sub>6</sub>= Farm assets

x<sub>7</sub>= Transport

### RESULT AND DISCUSSION

#### To assess the Socio-Economic Status of Farm Women

##### Family distribution

To understand the status and living standard of farm women, women were categorized into different land holding size and according to their caste.

The perusal of Table 1 shows the distribution of families according to caste i.e. divided into three categories: SC/ST, General and OBC. In canal irrigated area, SC/ST had 7 families, 15 families were of General Category and 8 families were of OBC Category. In tube well irrigated area, SC/ST had 9 families, 5 families were of General Category and 16 families were of OBC Category. In un-irrigated area, SC/ST had 4 families, 13 families were of General Category and 13 families were of OBC Category. The families were also distributed according to land holdings and divided into three categories i.e. Small, Medium and Large. 10 families were selected from each category.

##### Farm women education

Educational status of the farm women is given in Table 2. According to the data in irrigated area 17 per cent women were illiterate, 50 per cent women hold primary educations, followed by 20 per cent secondary and 13 per cent higher secondary education. In tube well irrigated

Table 1: Distribution of families according to caste and land holdings

Particulars							(ha)
	Small	Medium	Large	SC/ST	General	OBC	Total
Canal	10	10	10	7	15	8	30
Tube well	10	10	10	9	5	16	30
Un-irrigated	10	10	10	4	13	13	30

**Table 2: Distribution of respondent according to educational status**

Particulars	(Per cent)		
	Tube well	Un-irrigated	Irrigated
Illiterate	23	50	17
Primary education	33	33	50
Secondary education	27	7	20
Higher secondary	17	10	13

area 23 per cent women were illiterate, 33 per cent women hold primary educations, followed by 27 per cent secondary and 17 per cent higher secondary education.

The level of education in irrigated and un-irrigated area was quite different. Illiteracy level in un-irrigated area was 50 per cent. It is a matter of worry that in this area only 50 per cent women were literate.

**Family occupation**

In canal area, 80 per cent of the families were dependent upon farming, 13 per cent of the families were also involved in enterprise and only 7 per cent families were involved in labour work. In tube well area, 67 per cent of the families were dependent upon farming and 33 per cent on enterprises. In un-irrigated area, 40 per cent of the families were dependent upon labour work which was quite differ from irrigated area, as they took agricultural activities in only one season so they were also involved in labour work and in other enterprise, 27 per cent of the families were involved in this. In farming only 33 per cent families were involved. On an average, all the households had farming as one occupation but maximum number of families earned also by labour work followed by enterprise.

**Table 3: Distribution of selected families according to occupation**

Particulars	(Per cent)		
	Farming	Labour	Enterprise
Canal	80	7	13
Tube Well	33	–	67
Un-irrigated	33	40	27

**To study the Participation of Farm Women in Agriculture and Non-Agricultural Related Activities**

For achieving this objective, data for total working hours of women in the family was collected regarding all the income generating activities.

**Share of women in agricultural activities in canal area**

Table 4, shows the share of both men and women in agricultural activities in canal irrigated area. In canal irrigated area, women have more than 50 per cent share in intercultural operation, harvesting, threshing and cleaning. Women were also involved in spraying and also in marketing of produce. 55.65 per cent of men were involved in land preparation while women have 44.34 per

**Table 4: Share of farm women in agricultural activities in canal area**

Particulars	(Per cent)	
	Men	Women
Land Preparation	55.65	44.35
Purchasing seed and seed treatment	87.77	12.23
Sowing	52.26	43.74
Irrigation	100.00	–
Intercultural operation	24.54	75.46
Spraying	59.91	40.09
Harvesting	40.76	59.24
Threshing and cleaning	42.07	57.93
Marketing of produce	86.36	13.64

cent share. In seed purchasing and seed treatment, share of men have 87.77 per cent which was very high in comparison to women. In sowing 52.26 per cent men were involved in sowing and women have 43.74 per cent share. Men have 100 per cent share in irrigation activity. Women have 75.46 per cent share in intercultural operation while men have 24.54 per cent share. In spraying 59.91 per cent men were involved while women have 40.09 per cent share. Women have more shares in harvesting and threshing and cleaning. But men have greater share in marketing of produce.

**Share of women in agricultural activities in un-irrigated area**

Table 5, shows the share of farm women in agricultural activities in un-irrigated area. In this area, women have more than 50 per cent share in sowing, intercultural operation, harvesting, threshing and cleaning. But in marketing of produce the share of women were nil. Also in spraying and seed treatment share of women was nil.

**Table 5: Share of farm women in agricultural activities in un-irrigated area**

Particulars	(Per cent)	
	Men	Women
Land Preparation	80.00	20.00
Purchasing seed and seed treatment	100.00	–
Sowing	47.88	52.12
Intercultural operation	35.39	64.61
Spraying	100.00	–
Harvesting	35.63	64.37
Marketing of produce	100.00	–
Threshing and cleaning	35.27	64.73

**Share of women in agricultural activities in tube well area**

The perusal of Table 6 shows the share of women in agricultural activities in tube well area. In tube well

**Table 6: Share of farm women in agricultural activities in tube well area**

Particulars	(Per cent)	
	Men	Women
Land preparation	70.00	30.00
Purchasing seed and seed treatment	100.00	–
Sowing	55.80	44.20
Irrigation	100.00	–
Intercultural operation	25.36	74.64
Spraying	74.64	25.36
Harvesting	39.82	60.18
Threshing and cleaning	42.92	57.08
Marketing of produce	100.00	–

irrigated area also, women also have more than 50 per cent share in intercultural operation, harvesting, threshing and cleaning like canal irrigated and un-irrigated area. In land preparation men have 80 per cent share while women have only 20 per cent share. In purchasing seed and seed treatment, spraying and marketing of produce men have 100 per cent share. While in threshing and intercultural operation women have 64.73 and 64.61 per cent share respectively.

**Share of women in allied activities in canal area**

Table 7, shows the share of farm women in allied activities. Women have 100 per cent share in most of the activities. While men were only involved in fodder management and selling milk.

**Table 7: Share of farm women in allied activities in canal area**

Particulars	(Per cent)	
	Men	Women
Fodder management	78.26	21.74
Feeding of animals	–	100.00
Cleaning cattle shed	–	100.00
Milking	–	100.00
Selling milk	80.62	19.38
Papad making	–	45.00
Labour work	–	–

**Share of women in allied activities in un-irrigated area**

Table 8, shows that farm women in this area have 100 per cent share in many livestock activities, in addition they have 50 per cent share in labour work.

**Share of women in allied activities in tube well area**

Table 9, shows that women have 100 per cent share in feeding of animals, cleaning cattle shed and milking, and less than 50 per cent share in selling milk and fodder management. Women were not involved in labour work.

**To study the Impact of Income Generation on Women empowerment**

To analyse the impact of income generation on women empowerment, correlation analyses were attempted. It

**Table 8: Share of farm women in allied activities in un-irrigated area**

Particulars	(Per cent)	
	Men	Women
Fodder management	83.84	16.16
Feeding of animals	–	100.00
Cleaning cattle shed	–	100.00
Milking	–	100.00
Selling milk	–	100.00
Papad making	–	40.00
Labour work	50.00	50.00

**Table 9: Share of farm women in allied activities in tube well area**

Particulars	(Per cent)	
	Men	Women
Fodder management	85.71	14.29
Feeding of animals	–	100.00
Cleaning cattle shed	–	100.00
Milking	–	100.00
Selling milk	70.39	29.61
Papad making	–	40.00

was assumed that characteristics affect the share of women in income generating activities. For this purpose, correlation analysis was done.

**Correlation Analysis:** Correlation between per cent share of women in total income of households and socio-economic characteristics are presented in Table 11

In canal irrigated area, it was found that there was significant positive correlation between per cent share of income generated by women with age, farm assets while it was negatively correlated with caste. It was because of the fact that in the village, most of the OBC category of farm women were engaged in other occupations and were

**Table 10: Share of women in income generation activities**

Particulars	Per cent share in income
Un-irrigated	50.65
Tube well	53.33
Canal	61.20

**Table 11: Correlation between per cent share of income generated by women and socio-economic characteristics**

Socio-economic	Correlation Coefficient		
	Canal	Tube well	Un-irrigated
Age	0.2235**	–	–
Caste	-0.4453**	-0.3771	–
Occupation	–	–	0.3665**
Farm assets	0.2683**	–	-0.2442**

\*\* Significant at 5 per cent level

having good income. In tube well irrigated area, there were negative correlation between share of income and caste. In un-irrigated area, there were positive correlation between share of income and occupation, as in this area they have taken agricultural activities in only one season, so they were also engaged in other occupations also. There was negative correlation between farm assets and share of income.

### CONCLUSIONS

In irrigated area, 80 per cent families were involved in farming, but in un-irrigated area they were also well involved in other occupation due to agricultural activities in only one season. Illiteracy rate was also higher in un-irrigated area as compared to tube well and canal area. Distinct features regarding transport, farm assets were better in canal and tube well irrigated area. It is clear due to better condition of irrigation, socio economic condition of households as well as of women was better in irrigated area. Participation of women in farming in canal irrigated area was 61.2 per cent, in tube well area they have 53.33 per cent and in un-irrigated area participation of women was 50.65 per cent. Women have more participation in livestock activities in all the three areas. Women have more than 50 per cent participation in intercultural operations, harvesting, threshing and cleaning. Income has no significant correlation with most of the socio economic factor. It has only significant correlation with age, caste, farm assets and occupation.

### RECOMMENDATIONS

The heavy burden of domestic work of farm women workers should be shared by male workers to the possible extent for potential economic exploitation of women workers. Promotion of nutritional status, health and physical well-being emphasis especially for weaker sections would help them for better standard of living.

There is urgent need of better educational facilities especially for women in rural area which will be helpful them in general awareness and also the job oriented education so that they can establish their own enterprise. Training in livestock management is to be provided by government for raising the income levels. The Government should develop the special program to improve the condition of women of un-irrigated area. The Agricultural Universities, N.G.Os, *Krishi Vigyan Kendra* etc. should come forward to provide various types of training to farm women workers.

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## The Impact of Agricultural Credit Guarantee Scheme Fund (ACGSF) to Agricultural Produce in Nigeria

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### ABSTRACT

*Insufficient provision of credit has always constituted a causal factor of low domestic and foreign investment in agriculture sector in Nigeria. Hence, the establishment of ACGSF of Decree No. 20 came into existence in the year 1977. This study was carried out to examine the relationship between agricultural produce and agricultural credit guarantee scheme funds in Nigeria, using ordinary least square approach. Findings revealed that agricultural credit have significant and positive impact on agricultural produce in Nigeria. Hence, there is need to increase and sustain the amount of credits disbursed to the sector.*

(NI = \$315.8)

### Keywords

Agricultural credit, decree, guarantee, Nigeria, produce

### JEL Codes

C01, G00, G28, H81

### INTRODUCTION

The importance of agricultural credit as a factor of production to facilitate economic growth and development as well as the need to appropriately channel credit to rural areas for economic development of the poor rural farmers in Nigeria cannot be over emphasized. Credit (capital) is viewed as more than just another resource such as labour, land, equipment and raw materials. The involvement of banks in agricultural financing in Nigeria takes various forms. In addition to funding licensed buying agents, the banks fund project by corporate bodies, co-operative societies and individuals as well as groups of farmers. The banks lend to States and agricultural co-operatives who further lend to farmers. There is no doubt that the major force behind their involvement in food production in an appreciable level is the "big stroke" of the Central Banks Credit Guideline (Ojiegbe & Duruech, 2015).

Although Nigeria depends heavily on the oil industry for its budgetary revenues, still the country is predominantly an agrarian society. Approximately 70 per cent of the population engages in agricultural production at a subsistence level. Agricultural holdings are generally

small and scattered. Agriculture provided 24.18 per cent of Nigeria's total gross domestic product (GDP) in 2014. This per centage represented a decrease of 41.52 per cent from its contribution of 65.7 per cent to the GDP in 1957. The decrease will continue because, as economic development occurs, the relative size of the agricultural sector usually decreases (<http://www.nationsencyclopedia.com/>).

However, the agricultural sector suffered neglect during the hey-days of the oil boom in the 1970s. Ever since then Nigeria has been witnessing extreme poverty and the insufficiency of basic food items. Historically, the roots of the crisis in the Nigerian economy lie in the neglect of agriculture and the increased dependence on a mono-cultural economy based on oil. The neglect of the agricultural sector and the dependence of Nigeria on a mono-cultural, crude oil-based economy have not augured well for the well-being of the Nigerian economy. In a bid to address this drift, the Nigerian government as from 1975 became directly involved in the commercial production of food crops. Several large scale agricultural projects specializing in the production of grains, livestock, dairies and animal feeds, to mention but a few

were established. Sugar factories were also established at Numan, Lafiagi and Sunti. The Nigerian Agricultural and Co-operative Bank (NACB), Agricultural Credit Guarantee Scheme Fund (ACGSF) were established in 1973 and 1977 respectively as part of government's effort to inject oil wealth into the agricultural sector through the provision of credit facilities to support agriculture and agro-allied businesses (Onwumere *et al.*, 2012; Nwosu *et al.*, 2010).

The ACGSF was established by Decree No. 20 of 1977, and started operations in April, 1978. Its original share capital and paid-up capital were N100 million and N85.6 million, respectively. The Federal Government holds 60 per cent and the Central Bank of Nigeria, 40 per cent of the shares. The capital base of the scheme was increased to N3 billion in March, 2001. Most often, financial institutions require huge collateral from customers before loans are granted to them. This is detrimental to farmers' efforts that may require such loans to enhance their production. The Fund guarantees credit facilities extended to farmers by banks up to 75 per cent of the amount in default net of any security realized. The Fund is managed by the Central Bank of Nigeria, which handles the day-to-day operations of the Scheme. The Guidelines stipulate the eligible enterprises for which guarantees could be issued under the Scheme. The purpose of the scheme has been to encourage money deposit banks to lend to those engaged in agriculture by providing guarantee for loans granted by such banks for crops and livestock as well as fish production and processing as stipulated in the ACGSF Act of 1977 (CBN, 1990).

Other incentive put forward by the scheme to achieve its objectives includes the increase in the limit of the guarantee granted to individuals and corporate bodies. For example, the limit granted to individuals was increased from N5, 000 to N20, 000 for individuals without collateral required. While with collateral, the limit of the guarantee was increased from N100, 000 to N500, 000. For corporate bodies and corporative societies, the guarantee limit was increased from N1 million to N5 million. The above measures were geared towards the development of the agricultural sector. Furthermore, the ACGSF enforces the attainment of its objective by mandating commercial banks to set aside a fraction (10 per cent) of their profit before tax to farmers as loans and more so have a certain percentage of their branches set up in rural areas. This will enable effective reach to the target audience/beneficiaries. The Central Bank of Nigeria is supposed to ensure and enforce the compliance of the banks to these stipulations. Success story was accounted from these stipulations. These include that as at 2004, 11 out of 25 universal banks in the country are already participating in this scheme, while 669 eligible micro credit institutions have joined the scheme. Despite all these, the loan to the agricultural

sector by commercial banks still remains minute.

**Problem Statement**

Agricultural activities in Nigeria have undergone a constant decline as a result of more financing by government and other corporate organizations like commercial banks. Efforts have been made by previous governments to resuscitate agricultural activities by making provisions for loans so that agriculturists a vast majority of them being average Nigerians can have access to these loans to improve their production base and employ labour. Agricultural financing in Nigeria has proven to be fairly successful when it comes to getting these funds to the actual rural farmers who are in dare need of this assistance. Most often, financial institutions require huge collateral from farmers before loans are granted to them. This is detrimental to farmers' efforts that may require such loans to enhance their production. The ACGSF is aimed at reducing this dearth by guaranteeing these farmers or other individuals involved in agricultural production when seeking for loans from the banks. Over the years several cases of loan default was reported from various financial institutions under the scheme which course for serious alarm in the country's bid of achieving food security. For instance between 1978 and 1989 when the government stipulated lending quotas for banks under the Scheme, there was consistent increase in the lending portfolios of banks to agriculture, but after the deregulation of the financial system, banks started shying away by reducing their loans to the sector due to the perceived risk. This study is there for; aim at analyzing the impact of agricultural credit guarantee scheme fund (ACGSF) to agricultural production in Nigeria.

**METHODOLOGY**

**Sources of Data**

For the purpose of achieving the objectives of this study, data were basically drawn from secondary sources. Data involving the amount of loan disbursed and recovered under agricultural credit guarantee scheme funds in Nigeria, agricultural produce as well as urban and rural population were obtained from central bank of Nigeria (CBN) and National Bureau of Statistics (NBS), while those of annual rainfall were obtained from the Nigerian Meteorological agency.

**Model Specification**

Based on the analytical considerations of the study and literature reviewed the study adopts Saheed (2014) model with modification as presented below:

$$AP = f(ACGSF D, ACGSF R, UP, RP, AAR) \dots \dots \dots (1)$$

In stochastic form equation (1) becomes:

$$AP = \beta_0 + \beta_1 ACGSF D + \beta_2 ACGSF R + \beta_3 UP + \beta_4 RP + \beta_5 AAR + \varepsilon \dots \dots (2)$$

Where:

- AP = Agricultural produce
- RP = Rural Population
- UP = Urban Population
- AAR = Average Annual Rainfall

ACGSF D = Agricultural Credits Guarantee Scheme Funds Disbursed  
 ACGSF R = Agricultural Credits Guarantee Scheme Funds Repaid  
 $\varepsilon$  = Error term

**Testing of hypothesis**

$H_0$ : there is no significant difference between the amount of loan disbursed and the amount repaid  
 Paired t-test was used in testing the hypothesis  
 $H_0: \mu_D = D$  vs  $H_1: \mu_D \neq D$   
 Where:  
 $H_0$  = is null hypothesis  
 $H_1$  = is alternatives hypothesis  
 $\mu$  = population mean

The test criterion is we reject null hypothesis and accept the alternatives hypothesis if t calculated is greater than t tabulated.

$$t = \frac{\sum d}{\frac{\sqrt{n(\sum d^2) - (\sum d)^2}}{n-1}}$$

Where:

- d = is the mean difference between two samples,
- n = is the sample size and
- t = is a paired sample t-test with n-1 degrees of freedom.

**Unit Root Test**

To test for stationary of the secondary data that were used for the study a unit root test was carried out. Augmented Dickey Fuller (ADF) Test was used to test for unit root of the data. Given an observed time series  $Y_1, Y_2, Y_3, \dots, Y_n$  Dickey and Fuller consider three differential-form autoregressive equations to detect the presence of a unit root:

$$\Delta Y_t = \alpha + \beta t + \gamma Y_{t-1} + \sum_{j=1}^p (\delta_j \Delta Y_{t-j}) + \varepsilon_t$$

(with intercept and linear trend)

$$\Delta Y_t = \alpha + \gamma Y_{t-1} + \sum_{j=1}^p (\delta_j \Delta Y_{t-j}) + \varepsilon_t \text{ (with intercept only)}$$

$$\Delta Y_t = \gamma Y_{t-1} + \sum_{j=1}^p (\delta_j \Delta Y_{t-j}) + \varepsilon_t$$

(without intercept and trend)

Where:

- $t$  is the time index,
- $\alpha$  is an intercept constant called a *drift*,
- $\beta$  is the coefficient on a time trend,
- $\gamma$  is the coefficient presenting process root, i.e. the focus of testing,
- $p$  is the lag order of the first-differences auto

regressive process,

- $e_t$  is an independent identically distributed residual term.

The data were tested for each of the equation at various levels (level, first difference or second difference) (with intercept and trend, no intercept and without intercept and trend) until stationarity was achieved.

The decision rule is: If  $t^* < ADF$  critical value,  $\implies$  reject null hypothesis, i.e., unit root does not exist. Mean data is stationary.

**RESULTS AND DISCUSSION**

Table 1 presents the trend in the number of loans granted to farmers under agricultural credit guarantee scheme funds (ACGSF) in Nigeria. The total number of loans granted to farmers from N5000 and below category was high at the early stages of the programme from 1981-90 and decrease after word. This might be associated with the fact that farmers have less information about the scheme and were afraid to go for higher amount; Whereas in the second (N5,001 - N20,000), third (N20,001 - N50,000), forth (N50,001 - N100,000) and fifth (Above N100,000) categories, it increases upwards as the programme proceed between 2001-2010, with 50,430, 93731, 63679, 72810 number of loans respectively. It indicates that farmers not only became more aware of the terms and conditions of the scheme and willing to go for higher amount to fulfill the economic challenges regarding their agricultural activities but also want to benefit from the increase in the limit of the guarantee granted to individuals and corporate bodies.

Table 2 shows the trend in the amount of loans granted under agricultural credit guarantee scheme funds (ACGSF) in Nigeria to different farmers based on methods of farming. The life-stock farmers were the major beneficiaries (N94.7million) followed by food crop (N37.4million) of the total amount of loan disbursed from 1981-85 under the scheme. Similarly from 1986-2015 food crop farmers were the dominant over the total amount granted, recording (N23.04 million) from 2006-2010. It indicates that attaining food security is the ultimate of the goal of the scheme that is, a situation where everyone has access to food three times a day all year round at affordable prices in the country.

The result of the paired sample t-test was significant,  $t(23)=3.32$ ,  $P < 0.0005$ ,  $\mu_2=0.5$ , indicating that there is significance difference from the amount of loan repaid ( $M=1686197.49$ ,  $SD=2446803.57$ ,  $N=24$ ) to the amount of loan disbursed ( $M=2562594.86$ ,  $SD=3426621.68$ ,  $N=24$ ). The mean increase was 876397.38, with 95 per cent confidence interval for the difference between the mean of 330343.83 to 1422450.93, the null hypothesis was rejected (Table 3). This implies that despite the measures taken to monitor and supervised the beneficiaries still there were defaults to the financial institutions lending under agricultural credit guarantee scheme funds (ACGSF) in Nigeria since inception.

Augmented Dickey Fuller (ADF) unit root test was

**Table 1: Cumulative number of loans guaranteed under ACGSF operations value group basis**

(N'000, Number)

Year	Category				
	5000 and below	5,001-20,000	20,001-50,000	N 50,001-100,000	Above N100,000
1981-85	5991	1397	998	50	247
1986-90	105607	3939	1058	271	297
1991-95	84374	6823	1252	781	155
1996-2000	27453	40108	7071	3078	764
2001-2005	1396	50430	55755	27151	14823
2006-2010	287	24033	93731	63679	72810
2011-2015	250	16114	35325	37571	65316

Source: CBN, 2016

**Table 2: Cumulative amount of loans guaranteed under ACGSF operations base on methods of farming, value group basis (N'000)**

Years	Method of karmin			
	Cash crop	Livestock	Food crops	Mixed farming
1981-85	15329	94748.1	37458.1	7862
1986-90	65861	86514.6	348144.5	10431
1991-95	36862	44585.2	414597.5	1454
1996-2000	45977	113468	1042828	1205
2001-2005	214359	1260538	12521224	41093
2006-2010	698193	4861356	23041466	76640
2011-2015	659562	5639314	18306187	1960201

Source: CBN, 2016

used to examine the presence of stationarity in the variables employed in this study. The outcome of ADF test at first difference without intercept and trend shows t values of 3.3 which is less than the Augmented Dickey Fuller (ADF) 54.49 at .000 probability level, indicates that all the variables became stationary leading to the acceptance of the alternative hypothesis of the ADF test and subsequent adoption of the data for the study as depicted in Table 4.

The findings in Table 5 shows a robust Adjusted R. square of 0.745 indicating that about 74.5 per cent change in dependent variable (Agricultural produce) is explained by the explanatory variables (ACGSF D, ACGSF R, UP,

RP, AAR) four of these variables were found to be statistically significant at five per cent level. The coefficients of Agricultural loan disbursed and repaid under agricultural credit guarantee scheme funds in Nigeria (ACGSF) revealed that one per cent change will lead to 3.18 and 6.29 increase in the level of agricultural produce. This implies that availability and access of loan to farmers will go a long way in reducing the vicious cycle of poverty characterized by inadequate farm machinery, low income, savings and investment. Since credit is needed by both rural and urban farmers for enhanced productivity and agricultural development in the country. This findings supported earlier study by Saheed (2014) who reported that Agricultural Credit Guarantee Scheme Fund has positive and significant effect on agricultural productivity of the country.

Similarly, urban population was positive and statistically significant indicating that a change of one per cent will increase the level of agricultural produce by 2.31 per cent. This could be attributed to the fact that most of the people in the urban centers are literate, have access to relevant information and financial institutions given this loans. While rural population was negative but statistically significant indicating that one per cent increase in the number of rural population will bring about 3.78 per cent decreases in Agricultural produce. This may not be unconnected to the frequent migration of rural people to urban centers in serge of while color jobs.

**Table 3: Paired samples test**

	Paired differences				t	df	Sig. (2-tailed)	
	Mean	Std. deviation	Std. error mean	95 per cent confidence interval of the difference				
				Lower				Upper
Loan disbursed – loan repaid	876397.38	1293159.93	263965.17	330343.83	1422450.93	3.32	23	.003

Source: Eviews seven

**Table 4: Result of stationary (unit root test)**

Group unit root test: Summary  
 Series: ACGSFD, ACGSF\_R, AP, AAR, RP and UP  
 Date: 08/23/16 Time: 04:37  
 Sample: 1990–2012  
 Exogenous variables: None  
 Automatic selection of maximum lags  
 Automatic lag length selection based on SIC: 0 to 2  
 Newey–West automatic bandwidth selection and Bartlett kernel

Method	Statistic	P**	Sections	Observation
<b>Null: Unit root (assumes common unit root process)</b>				
Levin, Lin & Chu t*	3.31293	0.9995	6	117
<b>Null: Unit root (assumes individual unit root process)</b>				
ADF –Fisher Chi-square	54.4947	0	6	117
PP –Fisher Chi-square	82.9992	0	6	123

\*\* Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Source: Eviews seven

**Table 5: Result of regression analysis**

Regression Statistics	
Multiple R	0.862957432
R square	0.74469553
Adjusted R square	0.66960598
Standard error	7816.021639
Observations	23

ANOVA					
	df	SS	MS	F	Significance F
Regression	5	3029289338	6.06E+08	9.917432	0.000141
Residual	17	1038533302	61090194		
Total	22	4067822640			

	Coefficients	Standard error	t Stat	P-value
Intercept	306087.3385	80983.8039	3.779612	0.0015*
ACGSF D	0.318308518	0.150027074	2.121674	0.0487**
RP	-0.003785812	0.001456832	-2.59866	0.0187**
AAR	21.87248351	27.87528474	0.784655	0.4435
UP	0.002313823	0.000838151	2.760629	0.0134**
ACGSF R	0.62858321	0.228245343	2.75398	0.0136**

Note: \*significant at 1 per cent level and \*\*significant at 5 per cent level five

**SUMMARY AND RECOMMENDATIONS**

The study analyzed the impact of agricultural credit guarantee scheme fund (ACGSF) to agricultural production in Nigeria. The empirical evidence from the results of Adjusted R. square showed that there is significant and positive relationship between agricultural credit guarantee scheme fund (ACGSF) and agricultural produce. Despite the measures taken to monitor and supervised the beneficiaries still there were defaults to the

financial institutions lending under agricultural credit guarantee scheme funds (ACGSF) in Nigeria. Based on the above findings the following recommendations were made: Proper awareness of the scheme as most farmers especially those in the rural areas are oblivious of the scheme's objectives. It therefore behooves on the government (Federal, State and local Governments) to use its agencies like National Orientation Agency (NOA), Agricultural Development Programme (ADP) extension

officers and other relevant bodies to organize lectures on the scheme in the farmers' locality; also encouraged them to be applying for loans from the participating banks to enhance their agricultural activities and productivity. Finally, government should ensure that bank claims as a result of default and borrowers' interest draw backs are paid without delay. This will not only motivate both participating banks and farmers in the scheme but will also attract others who are skeptical.

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## **An Economic Analysis of Impact on Income and Employment of Rural SHG Women through SHG Enterprise**

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### **ABSTRACT**

*The SHGs have a role in hastening country's economic development. The data were related to socio-economic characteristics, income, employment, market margin, constraints and suggestions of women in self help groups of Maharashtra were studied in the present paper. It is concluded that the percentage increase in income was 124.11 percent. Whereas, agriculture income was increased to 20.10 per cent. Non agriculture labour income and agriculture labour income decreased to 18.27 and 25.68 per cent respectively. The percentage increase in employment was 80.48 percent. Whereas agriculture employment was increased to 5.95 per cent. Agriculture labour employment and non agriculture labour employment decreased to 26.79 and 20.83 per cent, respectively.*

### **Keyword**

Agriculture labour employment, market margin, non agriculture labour income

### **JEL Codes**

M5, I38, Z1, P36

### **INTRODUCTION**

Self Help Group in short is now a well known concept .It is now almost two decade old .It is reported that the SHGs have a role in hastening country's economic development. SHGs have now evolved as a movement. Mainly members of SHGs are women. Consequently, participation of women in the country's economic development is increasing. They also play an important role in elevating the economic status of their families. This has boost to the process of women's empowerment. According to one estimates in India a total of 29.24 lakh Self Help Groups in 587 districts have been formed until March 2007 and about ₹18,040 crore have been disbursed to these SHGs. The refinance assistance of ₹5446.49 crore has been provided to these SGHs up to the year 2007 and 3.36 crore families are benefited. In Maharashtra a total of 1, 23,295 SHGs are established and Konkan region is leading in the formation of Self Help Groups (NABARD 2007). In Maharashtra 2, 56,844 SHGs are established. In Parbhani district 4579 SHGs are reported out of which 4021 SHGs are formed by Women in the district (DRDA office, 2011-2012). Several positive claims are made in

support of the SHG movement. It is said that due to formation of SHGs the rural poor's are helping each other. The co-operation and unity among the members is also strengthened. Saving habits of poor people are also increased. It provides year round employment to the members by taking income generating activities and improves their economic conditions and standard of living. The impact of this credit given to SHG members on their saving, income and employment has been studied in the past by few researchers. But such type of studies and specially related to SHGs managed by women has not been scientifically conducted in Parbhani district. Therefore, it was felt that the information on these aspect is necessary, so as to decide the strategies for effective implementation of this programme. With these considerations, the present study entitled "Impact assessment of women's self help groups on Employment and Income in Marathwada region of Maharashtra is carried out with following specific objectives: To examine the impact of SHGs on income and employment of rural women through SHG activities and To study impact on Income and Employment of Rural SHG

Women through SHG Enterprise

### METHODOLOGY

Multistage sampling design was used in selection of district, tehsils, villages and SHG group. In the first stage, Parbhani district was purposely selected because of the number of SHG group formed in the district and such type of studies and specially related to SHGs managed by women has not been scientifically conducted in Parbhani district. Therefore, that the information on these aspect is necessary, so as to decide the strategies for effective implementation of this programme.

In the second stage, a list of tehsils along with number of SHG functioning in these tehsils was obtained from district authorities. Parbhani tehsil was selected purposely because this having maximum agriculture base women enterprises in the district. Thus, Parbhani tehsil was selected purposely.

In the third stage, the list of SHG was obtained from district rural development agency of Parbhani district. From these 7 buffalo and 7 goat rearing enterprise self help groups were selected randomly. The cross sectional data was collected from all members of the group, 70 members from buffalo SHG and 80 members from Goat SHG hence 150 women members cross sectional data was collected from the selected SHGs. The data for the study were collected during 2013-14. The data were related to socio-economic characteristics, income, employment, market margin, constraints and suggestions of women in self help groups.

### OBJECTIVES

1. to study economic status level of respondent after providing microfinance and
2. to study impact on Income and Employment of Rural SHG Women through SHG Enterprise

### RESULTS AND DISCUSSION

The purpose of forming SHG affiliated enterprises is said to be achieved only if the women entrepreneurs are economically empowered. In this study economic impact of SHG on its members is analysed during the before and after membership period by taking the variables like income, employment, asset position, saving, borrowing and consumption. These five fundamental variables determining the economic status of a member as identified.

#### Economic Status Level of Respondent after Providing Microfinance in the Buffalo SHG

Economic status level of rural SHG women was analysed during before and after participation by taking the variables Income, Employment, Asset creation, saving, borrowing, and consumption and presented in Table 1. The employment level of respondent under high employment category ( $>172.03$  mandays) per annum increased from 20 per cent to 98.57 per cent after providing micro finance in the SHG. While in medium ( $\geq 131.34$  mandays to  $\geq 172.03$  man days) category was decreased from 30 per cent to 10 per cent.

In the case of annual income of the respondent, under

high income category ( $>₹20987.54$ ), income increased from 17.14 to 45.71 per cent after providing micro finance while in low ( $<₹17615.44$ ) and medium ( $\geq ₹17615.44$  to  $₹20987.54$ ) category, it was decreased from 48.57 to 14.28 per cent and 34.29 to 4 per cent respectively. In regards to asset creation observed that the respondent at high asset ( $>₹8334.53$ ) category increased from 30 per cent to 65.72 per cent after providing micro finance in buffalo SHG respondent. There was subsequent decrease in percentage of medium ( $\geq ₹7836.47$  to  $₹8334.53$ ) and low ( $<₹7836.47$ ) asset category of respondent from 35.71 per cent to 20 per cent and 34.29 per cent to 14.28 per cent respectively.

In respect of the saving of the respondent, the percentage of respondent under high ( $>₹1772.01$ ) savings category increased from 28.57 to 81.43 per cent after providing micro finance. In case of medium ( $\geq ₹1485.59$  to  $₹1772.01$ ) and low ( $<₹1485.59$ ) saving category percentage of beneficiaries decreased from 31.42 per cent to 14.28 per cent and 40 per cent to 10 per cent respectively. With respect to borrowing, high ( $>₹2902.38$ ) percentage borrowing category was decreased to 17.21 per cent after providing microfinance where as medium ( $\geq ₹2625.62$  to  $₹2902.38$ ) category it was decreased from 31.43 per cent to 14.29 per cent. In regards to consumption, the consumption level of the respondent under high consumption category ( $>₹3432.98$ ) per annum increased from 17.14 per cent to 81.43 per cent after providing microfinance in the SHG. While in low ( $<₹3102.31$ ) and medium ( $\geq ₹3102.31$  to  $₹3432.98$ ) category it was decreased from 51.43 to 11.43 per cent and 31.14 to 14.29 per cent, respectively.

#### Economic status level of respondent after providing microfinance in goat SHG

Economic status level of rural SHG women was analysed during before and after participation by taking the variables Income, employment, asset creation, saving, borrowing and consumption and are presented in Table 2. The employment level (No. of days) of respondent under high employment ( $>241.65$  mandays) category per annum increased from 20 per cent to 83.75 per cent after providing micro finance in the SHG. While in medium ( $\geq 110.41$  mandays to  $241.65$  mandays) category it was decreased from 23.75 per cent to 11.25 Per cent. With respect to annual income of the respondent, It was observed that the percentage of respondent with high income ( $>₹13543.46$ ) category increased from 22.50 per cent before providing micro finance to 75 per cent after providing micro finance. Majority of respondent (75 per cent) felt under high income category after providing micro finance. Where as in low ( $<₹8157.09$ ) and medium ( $\geq ₹8157.09$  to  $₹13543.46$ ) income category it was decreased from 47.15 per cent to 10 per cent and 30 per cent to 15 per cent respectively. In regards to asset creation observed that the respondent at high asset

**Table 1: Economic status level of buffalo SHG respondents after participating in the SHG**

Categories	Before		After	
	Frequency	Per cent	Frequency	Per cent
<b>Employment (man days)</b>				
Low (<131.34)	35	50.00	2	2.86
Medium ( 131.34 to172.03 )	21	30.00	7	10.00
High (>172.03)	14	20.00	69	98.57
<b>Mean</b>	<b>151.26</b>		<b>256.42</b>	
<b>SD</b>	<b>46.86</b>		<b>26.89</b>	
<b>Income (₹)</b>				
Low (<17615.44)	34	48.57	10	14.28
Medium ( 17615.44 to 20987.54 )	24	34.29	28	40.00
High (>20987.54)	12	17.14	32	45.71
<b>Mean</b>	<b>19353.4</b>		<b>28706.8</b>	
<b>SD</b>	<b>3845.05</b>		<b>7690.11</b>	
<b>Asset(₹)</b>				
Low (<7836.47)	25	35.71	10	14.28
Medium ( 7836.47 to 8334.53 )	24	34.29	14	20.00
High (>8334.53)	21	30.00	46	65.72
<b>Mean</b>	<b>8105.88</b>		<b>11247.5</b>	
<b>SD</b>	<b>632.12</b>		<b>799.19</b>	
<b>Saving (₹)</b>				
Low (<1485.59)	28	40.00	3	
Medium ( 1485.59 to1772.01 )	22	31.42	10	14.28
High (>1772.01)	20	28.57	57	81.43
<b>Mean</b>	<b>2628.8</b>		<b>3928.38</b>	
<b>SD</b>	<b>336.96</b>		<b>376.74</b>	
<b>Barrowing (₹)</b>				
Low (<2625.62)	12	17.14	48	68.57
Medium ( 2625.62 to 2902.38 )	22	31.43	12	17.14
High (>2902.38)	36	51.43	10	14.29
<b>Mean</b>	<b>12764.00</b>		<b>11778.00</b>	
<b>SD</b>	<b>325.6</b>		<b>250.6</b>	
<b>Consumption (₹)</b>				
Low (<3102.31)	36	51.43	8	11.43
Medium ( 3102.31 to 3432.98 )	22	31.43	10	14.29
High (>3432.98)	12	17.14	57	81.43
<b>Mean</b>	<b>11452.80</b>		<b>13454.32</b>	
<b>SD</b>	<b>389.02</b>		<b>410.01</b>	

(>₹8317.90) category increased from 20 per cent to 82.50 per cent after providing micro finance in goat SHG respondent. There was subsequent decrease in percentage of medium ( $\geq ₹7775.52$  to  $₹8317.90 \leq$ ) and low ( $< ₹7775.52$ ) asset category at respondent from 35 to 12.50, 45 per cent to 7.50 per cent respectively. Findings were consistent with results obtained by Vatta *et al.* (2001) in regards to performance of SHG.

In respect of the saving of the respondent, the percentage of respondent under high ( $> ₹1594.59$ ) savings category increased from 17.5 per cent to 81.25 per cent

after providing micro finance. In case of medium ( $\geq ₹1505.91$  to  $₹1594.59 \leq$ ) and low ( $< ₹1505.91$ ) saving category percentage of beneficiaries decreased from 27.50 per cent to 12.50 per cent and 55 per cent to 6.25 per cent respectively. With respect to borrowing, high ( $> ₹4456.33$ ) percentage borrowing category was decreased to 15.00 per cent after providing microfinance whereas medium ( $\geq ₹4112.65$  to  $₹4456.33 \leq$ ) category it was increased from 18.75 to 25.00 per cent. In regards to consumption, the consumption level of the respondent under high consumption category ( $> ₹2621.34$ ) per annum

**Table 2: Economic status level of goat SHG respondents after participating in the SHG**

Categories	Before		After	
	Frequency	Per cent	Frequency	Per cent
<b>Employment (mandays)</b>				
Low (<110.41)	35	43.75	4	5.00
Medium ( 110.41 to 241.65 )	19	23.75	9	11.25
High (>241.65)	16	20.00	67	83.75
<b>Mean</b>	<b>155.26</b>		<b>296.03</b>	
<b>SD</b>	<b>154.41</b>		<b>67.44</b>	
<b>Income (₹)</b>				
Low (<8157.09)	38	47.5	8	10.00
Medium ( 8157.09 to 13543.46 )	24	30.00	12	15.00
High (>13543.46)	18	22.50	60	75.00
<b>Mean</b>	<b>10850.00</b>		<b>15311.53</b>	
<b>SD</b>	<b>6337.56</b>		<b>8059.42</b>	
<b>Asset (₹)</b>				
Low (<7775.52)	36	45.00	6	7.50
Medium ( 7775.52 to 8317.90 )	28	35.00	10	12.5
High (>8317.90)	16	20.00	66	82.50
<b>Mean</b>	<b>8046.71</b>		<b>10623.2</b>	
<b>SD</b>	<b>638.10</b>		<b>584.28</b>	
<b>Saving (₹)</b>				
Low (<1505.91)	44	55.00	5	6.25
Medium ( 1505.91 to 1594.59 )	22	27.5	10	12.50
High (>1594.59)	14	17.5	65	81.25
<b>Mean</b>	<b>2550.25</b>		<b>3960.25</b>	
<b>SD</b>	<b>104.33</b>		<b>135.88</b>	
<b>Borrowing (₹)</b>				
Low (<4112.65)	8	10.00	48	60.00
Medium ( 4112.05-4456.33 )	15	18.75	20	25.00
High (>4456.33)	57	71.25	12	15.00
<b>Mean</b>	<b>6284.49</b>		<b>4163.10</b>	
<b>SD</b>	<b>304.33</b>		<b>259.85</b>	
<b>Consumption (₹)</b>				
Low (<2362.66)	32	40.00	9	11.25
Medium ( 2362.66-2621.34 )	25	31.25	12	15.00
High (>2621.34)	23	28.75	59	73.75
<b>Mean</b>	<b>9927.32</b>		<b>10811.30</b>	
<b>SD</b>	<b>638.10</b>		<b>799.18</b>	

increased from 28.75 to 73.75 per cent after providing microfinance in the SHG. While in low (<₹2362.66) and medium (≥₹2362.66 to ₹2621.34) category it was decreased from 40 to 11.25 per cent and 31.25 to 15 per cent respectively.

### **Impact on Income and Employment of Rural SHG Women through SHG Enterprise**

#### **Income pattern of SHG women**

The income resulted from all sources from buffalo SHG and goat SHG sample had been given in Table 3. From the table it was revealed that Agriculture labour was the major source of income in buffalo SHG before starting activity which contributed 34.89 per cent of total income

followed by activity income (29.58 per cent), non agricultural income (11.30 per cent) and agricultural income (10.22 per cent). After joining SHG, income of the respondent had completely changed. SHG activity income share was increased to 53.84 per cent. The percentage increase in income was 264.28 per cent. Whereas agriculture income was increased to 12.25 per cent. Non-agriculture labour income and agriculture labour income decreased to 5.24 and 28.87 per cent respectively. The results were corroborated with the study conducted by Sharma (2010) and Kumar *et al.* (2008) with respect to impact on income and employment.

In regards to goat SHG respondents income pattern,

before starting the SHG activity agriculture labour income was major source of income in total income which contributed 34.15 per cent followed by non agriculture labour income (23.90 per cent), activity (20.99 per cent) and agriculture income (16.45 per cent). After starting SHG activity, SHG activity income had major share which was 32.78 per cent in total income. The percentage increase in income was 124.11 per cent. Whereas agriculture income was increased to 20.10 per cent. Non agriculture labour income and agriculture labour income decreased to 18.27 and 25.68 per cent respectively.

#### Employment pattern of SHG women

The employment pattern of buffalo SHG members and goat SHG members was presented in Table 4. The result shows that before participating in the SHG activity, agriculture labour provides maximum employment, 55.33 man days (36.58 per cent) followed by activity (27.65 per cent), non agriculture labour (22.58 per cent) and agriculture (13.19 per cent). After joining the

SHG activity, the employment increases tremendously. The SHG activity i.e. buffalo enterprise provides the maximum employment, 135.57 days (52.87 per cent). The percentage increase in employment was 224.87 per cent. Whereas agriculture labour employment decrease to 29.99 per cent followed by agriculture employment (13.04 per cent) and non agriculture labour (4.10 per cent).

In regards to goat SHG respondent's employment pattern, before starting the SHG activity agriculture labour provides maximum employment in total employment which contributed 42.79 per cent followed by non agriculture labour employment (23.14 per cent), activity (20.96 per cent), and agriculture employment (5.68 per cent). After starting SHG activity, SHG activity employment had major share which was 44.05 per cent in total employment. The percentage increase in employment was 80.48 per cent. Whereas agriculture employment was increased to 5.95 per cent. Agriculture labour employment and non agriculture labour

**Table 3: Income pattern of SHG women**

Sources of income	(₹per annum)					
	Buffalo keeping			Goat rearing		
	Before	After	Per cent change	Before	After	Per cent change
SHG Activity	5720.87 (29.56)	20839.74 (53.84)	264.28	2239.61 (20.99)	5019.12 (32.78)	124.11
Agriculture	1978.58 (10.22)	4740.94 (12.25)	139.61	1955.05 (16.45)	3277.62 (20.10)	67.65
Agriculture labour	6752.40 (34.89)	11174.65 (28.87)	65.49	2885.16 (34.15)	3728.17 (25.68)	29.22
Non Agriculture labour	2179.15 (11.30)	2028.88 (5.24)	6.90	2750.10 (23.90)	4132.00 (18.27)	50.25
Total ( 1 to 4)	19353.41 (100)	38706.8 (100)	—	10669.87 (100)	15311.53 (100)	—

Figures in parentheses are per cent to total

**Table 4: Employment pattern of SHG women**

Particular	(Mandays per annum)					
	Buffalo keeping			Goat rearing		
	Before	After	Per cent change	Before	After	Per cent change
SHG Activity	41.73 (27.65)	135.57 (52.87)	224.87	54.97 (20.96)	99.21 (44.05)	80.48
Agriculture	19.95 (13.19)	33.44 (13.04)	67.62	14.94 (5.68)	10.47 (5.95)	29.92
Agriculture labour	55.33 (36.58)	76.92 (29.99)	39.02	80.39 (42.79)	112.46 (26.79)	39.89
Non Agriculture labour	34.15 (22.58)	25.64 (4.10)	33.19	25.73 (23.14)	40.86 (20.83)	58.80
Total( 1 to 4)	151.26 (100.00)	256.42 (100.00)	—	176.03 (100.00)	263.03 (100.00)	—

Figures in parentheses are per cent to total

employment decreased to 26.79 per cent and 20.83 per cent respectively. These findings were consistent with results reported by Gangaiah *et.al.* (2006)

#### **CONCLUSIONS**

It is concluded that the percentage increase in income was 124.11 per cent. Whereas agriculture income was increased to 20.10 per cent. Non agriculture labour income and agriculture labour income decreased to 18.27 and 25.68 per cent respectively. The percentage increase in employment was 80.48 per cent. Whereas agriculture employment was increased to 5.95 per cent. Agriculture labour employment and non agriculture labour employment decreased to 26.79 per cent and 20.83 per cent respectively.

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## Impact of Crop Insurance on Farmers' Income in Pune District of Maharashtra

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### ABSTRACT

With the increasing commercialization of agriculture, the extent of loss due to adverse eventualities is rising. The question is how to protect farmers by minimizing such losses. A study was an attempt, conducted in Pune district of Maharashtra to assess the extent of marketing knowledge of respondents and to identify the problems faced by them under Crop Insurance Scheme in the study area. In Pune District only 13 per cent farmer are benefited by crop Insurance scheme and rest 87% were not benefited by any crop insurance scheme. So, farmers are to be promoted more about the crop insurance scheme so that it would facilitate in increasing their income.

### Keywords

Agriculture, awareness, crop insurance, impact, farmers' income

### JEL Codes

G22, O13, P36, Q13

### INTRODUCTION

Since years, the central and state governments have used several ways such as rescheduling of loans, writing off the loans and/or interest to mitigate the impact of these disasters. These measures are mostly of compensatory nature and are unable to cultivate risk taking nature of farmer. Calum *et al.* (2002) developed a theoretical model of input use by agricultural producer who purchase crop insurance, and thus may engage in moral hazard. The most rational method of protecting farmer's economy from different types of risks is to provide some kind of insurance against the possible adverse effect of different risks. Mani *et al.* (2012) found the farmers were not sure about their participation in crop insurance schemes and compensation amount deposited in their bank account because of communication gap between farmer and insurance provider. Pierro (2008) analyzed Christian Aid interest in crop/weather micro insurance (MI) as well as "involvement in micro insurance related products and Services". The crop insurance programme could, therefore, be considered not only as hedge to protect farm economy from the adverse effect of crop failure but also an incentive to the farmer to shoulder risk of using new technology affecting improvement in farming. Obviously, the process of modernization of agriculture could be accelerated with the multiplication of crop

insurance programme. Kumar (2013) measured awareness level, and identified farmer's perception and farmer's willingness in paying for crop insurance in Nuzvid, Krishna District, Andhra Pradesh.

In 1965, the Central Government introduced a Crop Insurance Bill and circulated a model scheme of crop insurance on compulsory basis to constituent state governments for their views. The bill provided for the Central Government framing a reinsurance scheme to cover indemnity obligations of the states. However, because of very high financial obligations none of the states accepted the scheme. On receiving the responses of state governments, the subject was considered in detail by an Expert Committee headed by the then Chairman, Agricultural Price Commission set up in July 1970 for full examination of the economic, administrative, financial and actuarial implications of the subject. Different experiments on crop insurance on a limited, ad hoc and scattered scale started in 1972-73. Das & Ray (2012), concluded that covering market risk and giving more advertisements to popularize as well as helping the farmer in getting more information regarding crop insurance. Singh & Jogi (2011) revealed that there is low awareness among the small and marginal farmer and high awareness among large farmer. By now we have the experience of a number of products including some of weather insurance.

In what follows is a brief on the past experience and availability of different products at present.

Though, agricultural insurance is largely in the public domain, some private efforts especially in weather insurance have also been there for some time. Their experience is not all that discouraging. The real challenge is to scale up the distribution and ensure fast claim settlement. India, thus, has a publicly administered crop insurance scheme since 1972. Uvaneswaran & Mohanapriya (2014) revealed that majority (30 per cent) of the farmer is dissatisfied about the crop insurance schemes and 27 per cent are highly dissatisfied. Small portions (15 per cent) of the farmer are highly satisfied about the crop insurance schemes. All the variants of the scheme introduced from time to time had flaws. Nevertheless India is not alone where public crop insurance has not been successful. In both developed and developing countries such insurance schemes have incurred losses without offering an effective product. Public crop insurance schemes are available to cultivator as means of reducing the cost associated with crop failure. The schemes, however, suffer from moral hazards and are very costly as payment eligibility is determined by crop damage assessment for each individual farmer. There is a feeling that it is not profitable proposition at all.

Recently new Crop Insurance Scheme has been launched by NDA govt. which Consist of following details.

1. Farmer to pay lower premiums, to get full sum insured unlike the capping previously.
  2. Efforts to be made to enhance coverage of area under crop insurance schemes from 23 per cent at present to 50per cent of gross cropped area.
  3. Remote Sensing Technology, smart phones and drones would be used for quick estimation of crop losses and early settlement of claims.
- In a historic move, Government has unveiled the Pradhan Mantri Fasal Bima Yojana. The Pradhan Mantri Fasal Bima Yojana will replace the existing National Agricultural Insurance Scheme (NAIS) and Modified NAIS (MNIAS). A new Pilot Scheme namely UPIS has also been approved (Table 1).
  - Under crop insurance schemes, efforts will be made to enhance the coverage of area from 23per cent at present to 50per cent of gross cropped area during next three year (Table 2).
  - The new crop schemes are pro-farmer and have been prepared after extensive consultations with various stake holders including Ministries/ Department, NITI Aayog, State Governments, Insurance regulatory and Development Authority, insurance companies etc.

### Crop Insurance in Maharashtra

In December 2013 the Agriculture Department of Maharashtra established a high level committee to prepare an action plan for development of agriculture in

the State. The committee has proposed that a labour intensive agriculture development should be the basis for the States increased economic growth, provided that institutional structures are developed to support small producer in the production and post-harvest phases. Agricultural development can be accelerated if there is a systems approach to production with due attention to marketing. The committee has reported a number of cases of progressive farmer that may be scaled up to larger areas. They concluded that future development of agriculture in Maharashtra would be based on innovations that would assure increased productivity, enforce norms that promote high quality and proper standards, protect the environment, and lead to financial profitability and sustainability of farm operations. The committee envisaged that significant gain in productivity would be achieved through optimum utilization of water, introduction of new high yielding hybrid varieties, adoption of IPM and INM technologies, increased efficiency in the use of production inputs, and effective production and dissemination of improved crop management practices. The sustainability and expansion of gains in productivity and profitability would come about as a result of the effective integration between producer, consumer, processor and exporter.

### Introduction to Study Area

Government of Maharashtra has identified cluster for area expansion of horticultural crops wherein Pune

**Table 1: Area covered under crop insurance scheme in Maharashtra**

Particulars	Season	Maharashtra	India
NAIS	<i>Kharif</i>	2,536,198	2,44,259615
	<i>Rabi</i>	3,850,010	8,50,81958
WBCIS	<i>Kharif</i>	55,23,59	4,13,40554
	<i>Rabi</i>	1,26,914	2,18,64720
MNAIS	<i>Kharif</i>	42,812	5,144,978
	<i>Rabi</i>	6,809	1,77,3245

Source:<http://www.maharashtrastat.com/agriculture/2/agriculturalinsurance/87483/nationalagriculturalinsuranceschemenais19972015/450076/stats.aspx>

**Table 2: Coverage of farmer under crop insurance scheme**

Particulars	Maharashtra	India
Farmer insured (No.)	3,09,77750	21,85,33091
Area insured (ha)	2,70,67322	32,67,95663
Sum insured (₹)	1,949,873	30,163,488
Premium collected (₹)	88,898	1,168,285
Claims paid payable (₹)	198,696	2,704,719
Farmer benefited (No.)	8,927,349	63,178,510

Source:<http://www.maharashtrastat.com/agriculture/2/agriculturalinsurance/87483/nationalagriculturalinsuranceschemenais19972015/450076/stats.aspx>

District falls in Western Ghat Region (Cluster 2). It was decided in the District Committee that crops of local economic importance. The area under crops like Grape, Banana and Gauva had increased up to 2885 ha from 2009 to 2013. Farm ponds (360) had constructed to ensure lifesaving irrigation to horticultural crops. Farmer shifted towards greenhouses (130) and shade net houses (163) for cultivation of vegetables and flower. Under post-harvest management, pack house (89) were constructed to increase marketability of farm produce (Table 3).

**Table 3: Study area**

Component	Area (In ha.)
Geographical area	15,62,000
Total area under cultivation	11,71,700
<i>Kharif</i>	3,76,400
<i>Rabi</i>	6,42,200
Summer	93,100

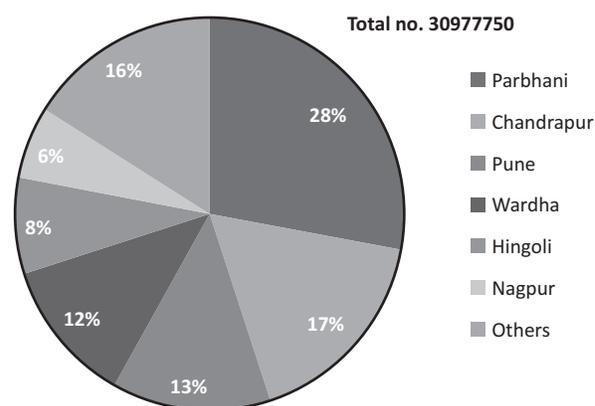
Source: <http://www.maharashtrastat.com/agriculture/2/agriculturalinsurance/87483/nationalagriculturalinsuranceschemenais19972015/450076/stats.aspx>

Table 4 exhibited the farmer covered under crop Insurance scheme in Maharashtra. In total Parbhani which ranks 1<sup>st</sup> which has highest difference of farmer covered & Pune which has ranked 3<sup>rd</sup> for the difference of covered & benefited farmer in that year.

**MATERIALS AND METHODS**

The study was conducted in Pune district of Maharashtra to assess the extent of marketing knowledge of respondents and to identify the problems faced under Crop Insurance Scheme. To fulfil the specified objectives of the study, both primary and secondary data was

**Figure 1: per centage of farmer benefited crop insurance in Maharashtra**



Source: <http://www.maharashtrastat.com/agriculture/2/agriculturalinsurance/87483/nationalagriculturalinsuranceschemenais19972015/450076/stats.aspx>

collected for the study. Primary data was collected through pre-structured schedule containing both open-ended and closed-ended questions by personal interview with farmers and data also were collected by interviewing beneficiary and non-beneficiary farmers directly with help of a specially designed schedule. Secondary data was collected from Directorate of Agriculture, the records, reports and web portals of National Agriculture Insurance Scheme, Directorate of Agriculture, Banks, and Department of Agriculture, Maharashtra and Pune district Government publications, Journals, and Magazines. The research approach was descriptive. Interview schedule

**Table 4: Total number of farmer covered under crop insurance scheme in Maharashtra in year-2013**

Districts	Covered	Benefitted	Difference	Districts	Covered	Benefitted	Difference
Parbhani	363159	157905	205254	Nasik	298892	221486	77406
Chandrapur	265188	67753	197435	Bhandara	87594	14085	73509
Pune	199680	41475	158205	Raigarh	60429	6464	53965
Hingoli	169792	20200	149592	Osmanabad	357746	305322	52424
Nagpur	162023	16043	145980	Solapur	67738	15504	52234
Wardha	170534	30734	139800	Yavatmal	320126	270958	49168
Sindhudurg	144774	6917	137857	Ratnagiri	83924	37086	46838
Naded	373114	240148	132966	Kolhapur	40638	887	39751
Sangli	192065	64923	127142	Washim	236601	201579	35022
Satara	375328	253058	122270	Gondia	49071	16731	32340
Gadchiroli	129334	13758	115576	Latur	356040	330010	26030
Aurangabad	431769	330935	100834	Buldhana	401080	378165	22915
Dhule	183437	83597	99840	Beed	306384	286457	19927
Jalgaon	289232	195384	93848	Amravati	223203	206401	16802
Nandurbar	107927	21332	86595	Akola	301573	290951	10622
Ahmednagar	637928	557337	80591	Thane	52863	60644	-7781
Jalna	228458	150769	77689	Maharashtra	7667644	4894998	2772646

Source: <http://www.maharashtrastat.com/agriculture/2/agriculturalinsurance/87483/nationalagriculturalinsuranceschemenais19972015/450076/stats.aspx>

was used as an instrument for collecting information, which was having open and close-ended questions. After collecting the information, tabulation was done and depending upon analysis and interpretation of facts and figures, a report was prepared. For sampling, farmers who have experience on Crop Insurance Scheme and also farmers who have not taken benefit of crop Insurance Scheme were selected for the study. Four potential villages (Indapur, Junnar, Baramati and Daund) were selected as per their highest contribution for Production. Selection of district and Talukas were made by Judgmental sampling. 30 farmers (15 beneficiary and 15 non-beneficiary farmers) per village were selected on the basis of snowball sampling.

For analysis of two objectives following framework were used:

**Objective 1:** To study the present status of Crop Insurance Scheme in Study area

There are 3 insurance schemes presently available in Pune for farmer i.e. National Agriculture Insurance Scheme, Weather Based Agriculture Insurance Scheme and Modified National Agriculture Insurance Scheme. In these objective important features like objectives, area coverage, farmer covered, risk covered, premium rates, claim settlement process and benefits expected from schemes are included.

**Objective 2:** To study Farmer Awareness about the Crop Insurance Schemes

This objective includes analysis of awareness among non-beneficiary farmers with the help of Guttman Scale as analytical tool. It also identifies the satisfaction level of farmer & reason for dissatisfaction. Satisfaction levels of beneficiary farmers were analyzed with the help of Likert's scale.

## RESULTS AND DISCUSSIONS:

### Present status of Crop Insurance Scheme in Study area

The cropping pattern of Pune district as a whole and Junnar, Indapur, Baramati and Daund tehsil were dominated by cereal crops and magnitudes were 66.00, 62.42, 63.22, 76.09 and 72.74 per cent, respectively. The Baramati tehsil is the biggest producer of cereals among the district as a whole. The share of the pulse crops in the gross cropped area in the Junnar tehsil was 10.61 per cent, which was highest among other tehsil in the district. The Junnar teshil is leading in fruit and vegetable production

where as Indapur has highest area under oilseed crops. The cropping intensity was highest in Daund tehsil 131.13 per cent as compare to other tehsils.

The educational status of beneficiary and non-beneficiary farmers is shown in Figure 2. The Table indicates that out of 60 beneficiary farmers, 33.33 per cent were illiterate, 48.33 per cent were educated up to secondary level and 18.33 per cent were educated up to graduation or higher level. Similarly in case of non-beneficiaries farmers 40 per cent were illiterate, 50 per cent were educated up to secondary level and 10 per cent were educated up to graduation or higher level

Figure 3 depicts purpose of crop insurance by sample farmers. Majority of farmers (75 per cent) are adopting crop insurance schemes due to the compulsion by their financial institution. Whereas 18.33 per cent farmers adopt crop insurance schemes due to financial security while 6.6 per cent farmers go for crop insurance because of strong recommendation by the fellow farmers.

Figure 4 is mainly considered of how the farmers take the crop insurance from different source. Mostly they were taking by 44per cent by Bank , 29per cent were by taking by National Agriculture insurance scheme and rest 27per cent by Weather based insurance scheme.

We can see from the figure that the farmers whose income per annum is between 2.5 to 5 lacs are availing the crop insurance more followed by 25 per cent (whose annual income lies between 5 to 10 lakhs), 13 per cent (whose annual income lies between 0 to 2.5 lakhs) and lastly 8 per cent (farmers who have more than 10 lakhs of income per annum)

Figure 6 shows that out of 60 farmers 38 farmers were repaying the crop loan by sale of agriculture produce, 14 farmers were paying by sale of assets, 4 farmers were paying by taking another loan and other sources were limited to 7 farmers.

Figure 7 depicts risk management measures by beneficiary farmers in case of crop losses. Farmers were asked to give 1 to 10 numbers for selecting risk measures. After that, it was calculated by weighted average. Out of 60, 19 farmers were dependent on Government relief followed by 15 farmers who were dependent on crop insurance and 8 were dependent on bank loan. Main preference was given to government relief followed by crop insurance by beneficiary farmers.

**Objective 2: To study Farmer Awareness about the**

**Table 5: Distribution of cropping in pune district (area '000 ha)**

Particulars	Pune	Junnar	Indapur	Baramati	Daund	Others
Total cereals	823.64	74.48	71.82	86.23	83.25	146.4
Total fruit	14.25	6.59	3.29	2.69	1.62	9.882
Total oilseed crop	14.5	6.59	8.89	0.68	1.6	15.482
Total cash crop	61.47	9.84	15.43	6.91	17.83	25.292

Source: [http://shodhganga.inflibnet.ac.in/bitstream/10603/50910/9/09\\_chapter%204.pdf](http://shodhganga.inflibnet.ac.in/bitstream/10603/50910/9/09_chapter%204.pdf)

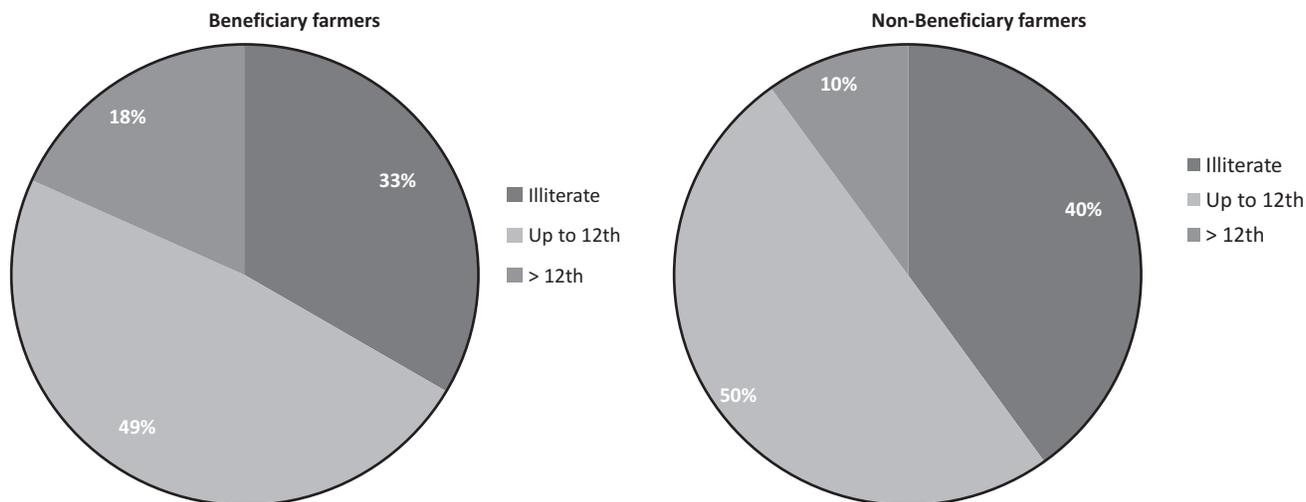
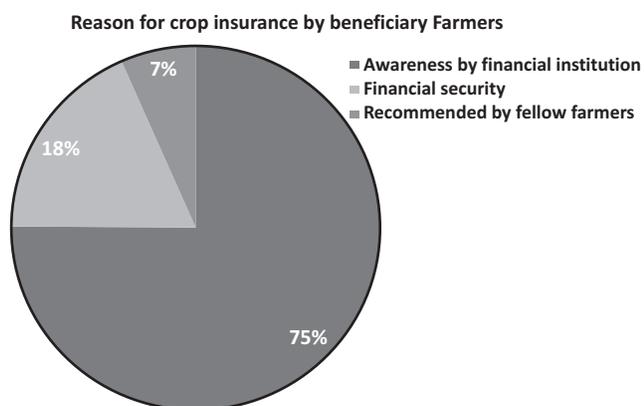


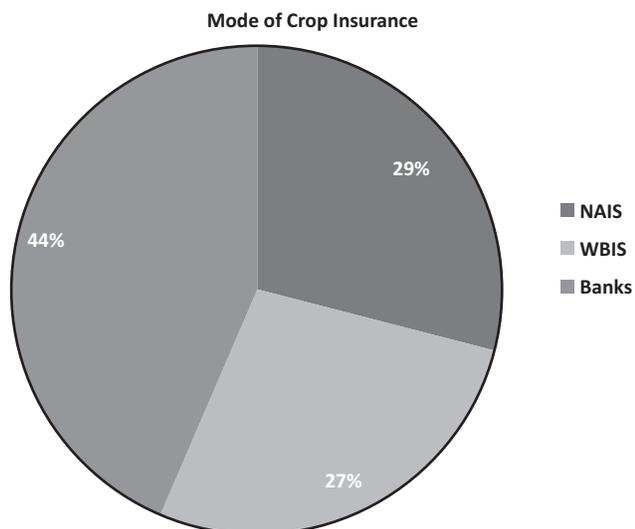
Figure 2: Educational status of beneficiary and non-beneficiary farmers

Figure 3: Reason for crop insurance by beneficiary farmers (Sample Size= 60) Source of crop insurance



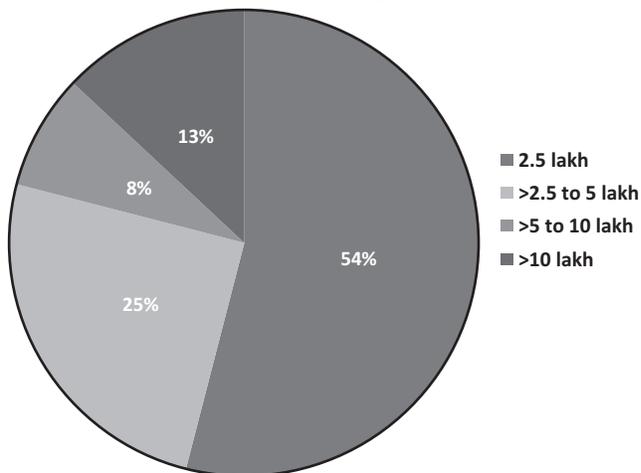
Source: Primary Data

Figure 4: Mode of crop insurance (Sample Size= 60)



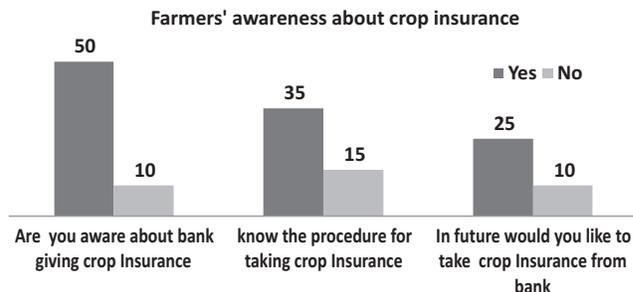
Source: Primary Data Collection

Figure 5: Distribution of beneficiary farmers according to annual income (Sample size= 60)



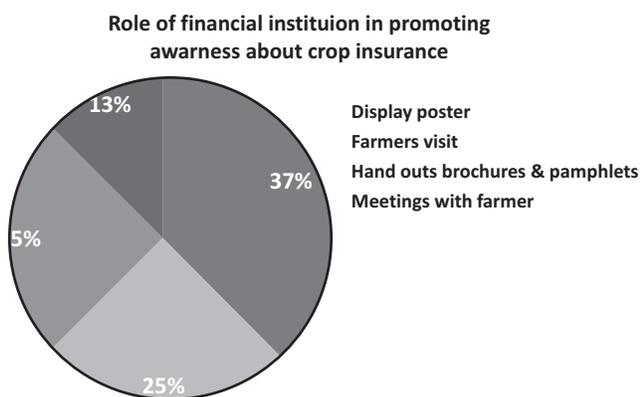
Source: Primary Data Collection

Figure 8: Farmers' awareness about crop insurance (Sample size: 60)



Source: Primary Data Collection

**Figure 9: Role of financial institutions in promoting awareness about crop insurance**



Source: Primary Data Collection

### Crop Insurance Schemes

From the Figure 8, interpreting from the Guttman scale it was found that out of 60, 50 farmers were aware about the banks giving crop insurance and out of 50, 35 farmers know the procedure for the crop insurance but out of 35 only 25 farmers had the interest in availing the crop insurance in future.

It was found from the study that to aware the farmers for the crop insurance, financial institutions give more importance to posters display, which is 37 per cent, 25 per cent to farmers visit, also 25 per cent to handouts, brochures and pamphlets and lastly 13 per cent to farmers meeting.

### CONCLUSIONS

Current process is that the period between date of issuance of notification and cutoff date is hardly 15 days which is definitely insufficient period for farmers to know about and opt for it. In case of Agency of relief of loss out of 60 farmers 19 were dependent on Government relief rather than taking crop insurance. 75 per cent farmers adopted crop insurance schemes due to awareness of

financial institution. Only 18.33 per cent farmers replied the financial security as a reason for crop insurance. The crop insurance has an important role in increasing the farmers' income as the farmers will be less vulnerable to risks and uncertainties after doing crop insurance. The financial institutions play a vital role in promoting crop insurance. The study revealed that the awareness for the crop insurance is increasing because of the financial institutions' initiatives. Due to the unawareness about the crop insurance scheme, the farmers are more depended on government in crop loss. So, farmers are to be promoted more about this so that it would facilitate in increasing their income.

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## **An Analysis of Transformation of Agro-Skills into Income through Vocational Trainings**

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### **ABSTRACT**

*Doubling the income of farmers by 2022 is on the high agenda of policy makers in India. For balanced development and growth, the farmers will have to search for regular employment opportunities to enhance the family income. To generate the regular on farm employment, the farmers can adopt one or more agro-based occupations and for this getting training is vital. Skill developments through trainings can help to bridge the enormous gap between the remarkable production achieved by the scientists and that by the farmers. Rural entrepreneurship is required for enhancement of income and employment among the rural masses. It was observed in the study that almost half of the skilled trainees in the study area utilized their skills to start a new venture. It indicates a tough path for improvements in income and employment generation in the rural areas. The main reasons for the limited transformation of skills into income generation were due to the marketing problems and paucity of the funds. Therefore, regulated and institutional marketing support system for agricultural produce is required. Agricultural market intelligence cells at district level in Farm Advisory Service Centers in collaboration with line departments may be established for location specific agricultural marketing support. Therefore market led integrated skill development programs are required in quantity and quality. Organized banking can also be encouraged for more efficient income accounting. Account payment transactions for marketing of agricultural produce should be promoted. Separate bank account for rural women can increase their access to family income and participation in the economic activities.*

### **Keywords**

Adoption, agro skill, constraints, enterprise, trainings

### **JEL Codes**

C12, C82, Q16, Q19

### **INTRODUCTION**

India, which is considered as agrarian economy, is now led to the increase in newer employment avenues due to globalization. Balanced development and growth of Indian economy is possible only when rural areas will flourish as nearly 73 per cent of the total population of India lives in the rural areas. About 60 per cent population of the country is supported by the farming occupations. Due to the population growth and fragmentation of land holdings, the size of the farming units becoming smaller. As a result there are the problems of underemployment and regular income generations in the rural areas. Therefore the profit margins of farmers were shrinking. For the enhancing farm income sustained and regular income throughout the year is required for farmers on the basis of improved technology and backed by continuous knowledge support. The Krishi Vigyan Kendras, initiated

by Indian Council of Agriculture Research (ICAR), started vocational trainings, which are playing important role for generating new employments for rural youth (Nazir *et al.*, 2013). Juma & Spielman (2014) found out that in Africa, improvement in infrastructure, education, resourcing and wider enabling environment can expand the choices available to farmer-entrepreneur, thereby, offering greater opportunity to manage risk, increase their income and improve their livelihoods. The farmers will have to search for regular employment opportunities to improve the family income. To generate the regular on farm employment the farmers can adopt one or more agro-based occupations and for this getting training is vital. Institutions and individuals promoting rural development now see entrepreneurship as a strategic development intervention that could accelerate the rural development process (Saxena, 2012). Rural

entrepreneurship is the attempt to create value through recognition of business opportunity, the management of risk-taking appropriate to the opportunity, and through the communicative and management skills to mobilize human, financial and material resources necessary to bring a project to fruition in rural areas (Nandanwar, 2011). The productivity of the adopted subsidiary enterprise sometimes becomes stagnant due to the unrecognizable constraint(s) not identified by the farmer and under such circumstances, necessary technical expertise or skill is required to break the impasse realized by the farmer (Hari *et al.*, 2008). Skill developments through trainings and Farmer Field Schools (FFS) can contribute to increasing farmers' skills and can help to bridge the enormous gap between the remarkable production achieved by the scientists and that by the farmers (Tripp *et al.*, 2005). In the backdrop of this, present study was undertaken with the following objectives:

- i. to study the adoption gaps of various skill development efforts in the study area,
- ii. to identify the obstacles for capacity utilization of the developed skills, and
- iii. to suggest possible solutions for transformation of skills into income

#### METHODOLOGY

Krishi Vigyan Kendras (KVKs) are district level farm science institutes aiming at speedy transfer of technology from farm scientists to farmers. To achieve the stipulated objectives, various skill development efforts made by KVK, Amritsar of Punjab were studied. During the year 2011-12, KVK, Amritsar had organized vocational trainings on nine different subsidiary occupations (bee keeping, nursery raising, mushroom cultivation, food preservation, fabric painting, candle making and poultry farming) of one week and more duration in which 284 farmers and farm women had participated. The primary data relating to socio-economic aspects of the respondents, reasons for getting trainings as well as their entrepreneurial capability were collected by personal interview method during pre and post training period with the help of specially designed questionnaires. Further, the statistical tools such as average, percentage, etc. were used for the analysis of the data. The tabular presentation was undertaken to bring forth the fruitful conclusions and suggestions.

#### RESULTS AND DISCUSSION

The study was mainly focused on various skills development efforts for enhancement of income and employability in the study area. Various issues and aspects have been discussed with the stakeholders and one of these major aspects is the social and economic background of the trainees.

##### Socio-economic Background

Analysis of data relating to socio-economic background of the selected respondents revealed that maximum (42.61 per cent) of the trainees were from the

age group of 20 to 30 years followed by 36.62 per cent belonging to age group of 30-40 years (Table 1). About 20 per cent of the trainees were 40-50 years old and only about one per cent were above 50 years of age. The education level of most of the trainees (46.48 per cent) were up to senior secondary, while 38 per cent were matriculates, about 14 per cent were graduates and only about 2 per cent were illiterates who did not even know to write their names. Further, about 70 per cent of the respondent had married status. Out of the total respondents only about 58 per cent were female though out of nine trainings, four were related with women or household work only. Majority of the respondents were from small farm category (53.17 per cent), having 5 and less acres of land holding and only about 7 per cent were large (having more than 10 acres of land).

##### Reasons for Getting Training

A person is motivated by certain causes which enhance or reduce his/her capacity to adopt a new technology. The perception of the trainees to get a particular training was also studied. It was observed that out of total trainees maximum (77.46 per cent) were lured

**Table 1: Socio-economic background of the sample trainees**

Characteristics	(N=284)	
	No. of respondents	Percentage
<b>Age (years)</b>		
20-30	121	42.61
30-40	104	36.62
40-50	56	19.72
50 and above	3	1.06
<b>Educational level</b>		
Illiterate	6	2.11
Upto matric	108	38.03
Upto senior secondary	132	46.48
Graduate	38	13.38
<b>Marital status</b>		
Married	200	70.42
Unmarried	84	29.58
<b>Sex</b>		
Male	120	42.25
Female	164	57.75
<b>Land holding</b>		
Landless	12	4.23
Small (up to 5 acres)	151	53.17
Medium (5-10 acres)	102	35.92
Large (> 10 acres)	19	6.69
<b>Size of family</b>		
Upto 4	38	13.38
5-8	166	58.45
8 and above	80	28.17
Total trainees	284	100.00

by the subsidy available e.g. subsidy for bee keeping which covers 40 per cent of the total cost involved (Table 2). Further, about 76 per cent of the respondents were interested in improvement of their existing skills and knowledge. About 73 per cent were willing to start a new enterprise. It was also observed that 12.68 per cent trainees acquired the trainings to get a course completion certificate only either to utilize their free time or to get a job in a Government institution based on the certificate. Importance of help in household and farming activities was also realized by some respondents (25.35per cent) as a reason for getting the training.

**Occupational Adoption by Sample Trainees**

It was observed by the trainers that there was gain in knowledge as well capacity improvement of all the trainees due to skill development programme through pre and post training evaluations. Transformation of skills should be followed by occupation adoption as solely supply of skills is not sufficient for income and employment generation in the rural areas. It was observed during the survey that about 55 per cent of the respondents had utilised their acquired skills to start a new occupational activity. Therefore, almost half of the trainees have taken any initiative to utilize their skills into active economic activity. The highest benefits of transformation of skills into vocational occupation was observed in vegetables under low tunnel (75 per cent) followed by bee keeping (71.67 per cent). On the other hand, due to high perishability of mushrooms, the lowest

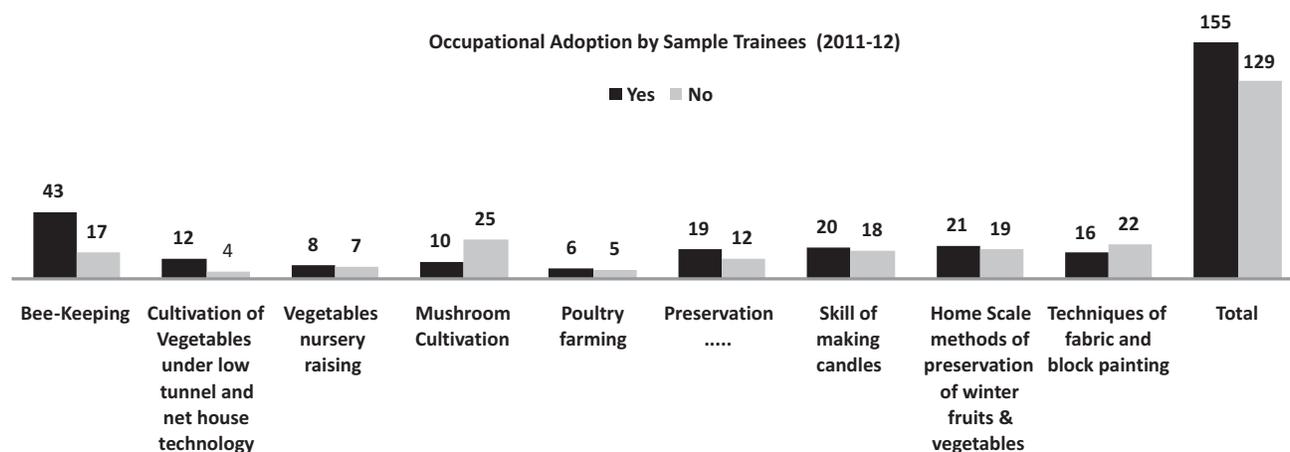
benefit was taken by these trainees to adopt a new economic activity (28.57 per cent). Women can play an important role in rural development. Therefore, special emphasis was given to the training needs of the women in the Scientific Advisory Committee (SAC) meeting of the KVK, Amritsar. As a result of participatory planning, out of major nine vocational training programmes by KVK, Amritsar, four were focused on women during the year. It was observed during the study that about 42 to 55 per cent trained women used their acquired skills for economic activities.

**Constraints to Start the Enterprise**

Sustainable farming is not an easy task for an individual for regular income and family livelihood. There may be various constraints and problems to start a new farm business. Marketing problems of agricultural produce was reported as the major constraint by the respondents (95.42 per cent) to opt for a new enterprise (Table 3). There is no assured marketing of honey, mushrooms, vegetables and other processed products for the farmers in the locality. The most of the farmers were having poor marketing skills and knowledge. They have poor knowledge of the supply chain and price behavior of the agricultural produce. Further, they also face difficulty in fixing standards and sticking to them with time. Paucity of funds and high input costs involved was also one of the major hinderances to start a new business as reported by about 80 per cent of the respondents. Therefore, these farmers were seeker of the subsidies and loans from the

**Table 2: Various reasons for getting the trainings at KVK, Amritsar**

Reason for getting the training	No. of respondents	Percentage
Start a new enterprise for income generation	206	72.54
To avail subsidy provided by the Government	220	77.46
To get job based on certificate from Govt. institution/utilize free time	36	12.68
Skill and knowledge improvement	216	76.06
To help in the household activities and family business	72	25.35



**Table 3: Various constraints for opting new Enterprise listed by the respondents**

(N=284)

Constraint	No.	Per cent
Marketing problems	271	95.42
Paucity of funds	227	79.93
Poor risk bearing ability	153	53.87
Competition with existing units	128	45.07
Fear of failure	101	35.56
Technical problems	95	33.45
Labour availability problems	81	28.52
Low scope of further opportunities	63	22.18
Social barriers/Hesitation in adopting new technology	54	19.01
Illiteracy	13	4.58

government to start their enterprise. Due to the poor economic conditions because of debt and other liabilities there were 53.87 per cent trainees who reported constraint of poor risk bearing ability. Competition with well-established existing units was also felt as a constraint for new comers by the 45.07 per cent respondents. Further, most of the rural entrepreneurs fail to get external funds due to absence of tangible security and credit in the market (Patel & Chavda, 2013). Customers prefer to purchase the nursery and finished products from the well-established units as compared to the new adopters. Fear of failure (35.56 per cent), technical problems (33.45 per cent), availability of labour (28.52 per cent) and low scope in future activities (22.18 per cent) were other constraints reported by the trainees for opting new enterprise. The personal will (hesitation) and environment in the family and society is not always conducive to encourage rural people to opt for a new enterprise and it becomes difficult to convince family/society to opt for new enterprise over what their forefathers were doing. Social barriers/hesitation in adopting of new technology (19.01 per cent) and illiteracy (4.58 per cent) were also affecting the decision of the respondents to opt for an enterprise.

**Suggestions to Improve the Transformation of Skills into Economic Activities**

In order to increase the success rate of skilled workers to start the farm business venture as well as to involve the rural masses in skill development activities the following suggestions are being made based upon the results and discussions with the various stake holders:

**Skill development in marketing:** The marketing problems of agricultural and processed products are a major constraint for transformation of skills to generate income and employment among rural masses. Technical and vocational education is more effective when focused on skills closely linked to market demand (Adams, 2012). Therefore there is need to promote the capacity of the trainers for market led skill development trainings. There is a need for utilization of available agricultural marketing information and intelligence with the establishment of

market intelligence cells at district level.

**Financial support:** Due to paucity of funds many trained workers were unable to utilize their skills properly. Therefore, government subsidies and credit facilities can help them for ball rolling of the new enterprises. The women access to the income in the family is also a constraint for proper utilization of women skills. Therefore, special credit cum debt account for the rural women can be started in local banks so that women can get better benefit of the various subsidies. Financial institutions and banks can provide finance to the entrepreneurs through easy finance with less complicated procedure.

**Group approach:** The producers are not collective in their approach for marketing of their products because they are widely scattered and less cooperative. Encouragement and assistance should be provided to rural entrepreneurs for setting up farmer producer organizations (FPO), marketing co-operatives, Self Help Groups (SHGs) and to adopt collective farming system approach.

**Create awareness:** There is a need for early dissemination of entrepreneurship education in the schools for timely exploration of entrepreneurial capabilities.

**Promotion and support to the fresher:** Promotion and support to new entrepreneurs is required to set the ball rolling with the help of providing free space for marketing and promotion of the product in the Kisan Melas, trade fairs, exhibitions, promotional huts etc. New initiatives can be promoted by recognitions and awards.

**CONCLUSIONS**

Rural entrepreneurship is required for enhancement of income and employment among the rural masses. It was observed in the study that almost half of the skilled trainees in the study area utilized their skills to start a new venture. It indicates a tough path for sustainable skill development efforts for regular income and employment generation in the rural areas. The main reasons for the limited transformation of skills were marketing problems and paucity of the funds. The regulated marketing

support system for agricultural produce and to set up agricultural market intelligence cells at district level in Farm Advisory Service Centers (FASCs) in collaboration with line departments can help the farmers for agricultural marketing. Therefore market led integrated skill development programs is required in quantity and quality. There is also need to motivate the rural youth to take up entrepreneurship as a career with training and education support at school level. Organized banking can be encouraged for more efficient income accounting. Account payment transactions for marketing of agricultural produce should be promoted. Separate bank account for rural women can increase their access to family income and participation in economic activities.

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## Adoption of Water Saving Technologies in Patiala District of Punjab

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### ABSTRACT

The study was conducted to know the extent of adoption of selected recommended water saving technologies by the farmers. Six villages from two blocks of Patiala were selected purposively. Twenty farmers from each village were selected randomly. Thus a total of one hundred twenty farmers were selected for this study. Data were collected by personally visiting the study area and interviewing the farmers. Finding of the study revealed that most of the respondents were educated up to matric and had medium operational land holding (10-25 acres). All of them were following paddy-wheat crop rotation. As far as agricultural machinery is concerned most of them (80.33 per cent) owned tractor. Mostly respondents fell in the category of high extent of adoption in case of laser leveller and most of the respondents belonged to medium level extent of adoption in direct seeded rice and zero tillage in wheat. There was no adoption of tensiometer by the farmers.

### Keywords

Adoption, direct seeded rice, water saving technologies

### JEL Codes

C81, O13, Q18, Q25

### INTRODUCTION

After green revolution, rice-wheat cropping system became the major cropping system in Punjab. The traditional method of rice/wheat cultivation in Punjab requires a large amount of labour, water and energy. Water is becoming increasingly scarce in this region, raising questions about the sustainability of rice/wheat production and the overall environment. The adoption of conservation practices may not be perceived as a priority for farmers until evidence of deterioration of the environment or alarmingly declining yield are visible (Gillet *et al.*, 2003). Rice-wheat could face a threat due to water shortage and hence there is need to develop and adopt water saving technologies in rice cultivation so that production and productivity levels are elevated despite the looming water crisis.

Water saving technologies such as zero tillage, laser land leveling and furrow bed planting have received attention in the context of increasing productivity of the rice-wheat cropping pattern and saving of increasingly scarce water resources. While the impact of water saving technologies on yield are easy to measure, impact on water saving are not well understood beyond the field

scale because of the complex movement of water. Cost of production and labour requirements, higher yield and reduced field scale irrigation water application are primary drivers for adoption of water saving technologies (Ahmad *et al.*, 2013). Punjab Agriculture University recommended water saving technologies such as direct seedling of rice, zero tillage in wheat, tensiometer, happy seeder and laser land leveler for efficient use of natural resources. But the adoption of water saving technologies has not yet achieved the desired level. Hence the present study was conducted to find out the adoption of selected recommended water saving technologies by the farmers in Patiala district.

### METHODOLOGY

Study was conducted in Patiala district of Punjab. Out of eight blocks, two blocks i.e. *Sanore* and *Bhunrheri* were selected purposively, where water saving technologies such as direct seeded rice, zero tillage in wheat, laser leveler and tensiometer were being practiced by the farmer. Three villages from each block were selected. These were *Panjola*, *Balwera*, *Manjaal*, *Nainkalan*, *Bhatian* and *Partapgarh*. Twenty farmers from each village were selected randomly thus

constituting the total sample size of 120 farmers. An interview schedule was prepared to collect data about socio-personal characteristics of the farmers and adoption of selected water saving technologies viz. direct seeded rice, zero tillage in wheat, laser leveler and tensiometer. The interview schedule was pretested on 20 non sampled farmers using water saving technologies. Necessary modifications were made in the light of pretesting.

**RESULTS AND DISCUSSIONS**

Results of the study have been discussed under the following headings:

**Socio Personal Characteristics of the Respondents**

The information regarding socio-personal characteristics of selected farmers which include age, education, operational land holding, agricultural machinery owned, crop grown was analyzed. The information pertaining to the profile of the farmers has been given in Table 1.

**Table 1: Distribution of respondents according to their socio-personal characteristics**

(n=120)			
Socio-personal characteristics	Category	Frequency (f)	Percentage (per cent)
Education	Illiterate	12	10.00
	Primary	17	14.17
	Secondary	21	17.50
	Matric	34	28.33
	Senior Secondary	24	20.00
	Graduation and above	12	10.00
Operational land holding (acres)	Marginal (<2.5)	2	1.67
	Small (2.5-5.0)	4	3.33
	Semi-Medium (5-10)	25	20.83
	Medium (10-25)	68	56.67
Crops grown	Large (>25)	21	17.50
	Rice	120	100
	Wheat	120	100
Agricultural machinery owned	Vegetables	23	19.17
	Tractor	97	80.33
	DSR drill	9	7.50
	Zero tillage drill	8	6.67
	Laser leveler	13	10.83
	Combine	5	4.17
	High (12-15)	6	5.00

**Education**

Data presented in Table 1 pertaining to education of the respondents showed that more than 28 per cent of the respondents had gained education up to matriculation, 10 per cent of them were illiterate, about 15 per cent had gained education up to primary, 17.50 per cent had gained education up to secondary, 20 per cent up to senior secondary while 10 per cent were graduate and above.

These findings are in agreement with the findings of Kaur (2007) and Kaur (2015).

**Operational land holding**

It was observed from the data presented in Table 1 that 56.67 per cent respondents had medium (10-25 acres) operational land holding, about 21 per cent of the respondents had semi-medium (5-10 acres) operational land holding, more than 17 per cent of the respondents had large (> 25 acres) operational land holding, only three per cent and about two per cent of the respondents had small (2.5-5.0 acres) and marginal (<2.5 acres) operational land holdings respectively. So it was observed that most of the farmers fell in the category of medium land holdings (10-25) acres. These findings are in line with Kaur (2007).

**Crops grown**

All respondents were growing rice and wheat crops. However about 19 per cent of the respondents were also cultivating vegetables along with rice and wheat crop.

**Agricultural machinery owned**

Data given in Table 1 showed that majority of the respondents (80.33per cent) possessed tractor. However, about eight per cent of the respondents had DSR drill, seven per cent had zero tillage drill and only four per cent respondents had combine harvester. While 10.83 per cent respondents had also owned laser leveler.

**Adoption of Selected Recommended Water Saving Technologies by the Farmers**

**Overall extent of adoption of selected recommended water saving technologies by respondents**

Overall extent of adoption for a selected technology was calculated by dividing the area under selected technology to the total area under cultivation by the respondents multiplying it by 100. The total cultivated by 120 respondents was 2098 acres. Data given in Table 2 witnessed that laser level has maximum extent of adoption among all selected water saving technologies. Laser leveler had been used by respondents on about 90 per cent area out of total cultivated area. Whereas zero tillage in wheat and direct seeded rice has very low extent of adoption i.e. 4.67 per cent and 3.72 per cent respectively.

**Extent of adoption of direct seeded rice**

Extent of adoption by respondents was measured in terms of proportion of area under recommended practice

**Table 2: Distribution of overall extent of adoption of selected recommended water saving technologies by respondents**

(n=120)		
Water saving technology	Area (acres)	Extent of adoption (per cent)
Direct seeded rice	78	3.72
Zero-Tillage wheat	98	4.67
Laser leveler	1891	90.13
Tensiometer	0	0.00

*Total cultivated area =2098 acres*

DSR (Table 3).

**Table 3: Distribution of the respondents according to extent of adoption for direct seeded rice**

(n=20)		
Extent of adoption (Scores)	Frequency	Percentage
Low (up to 17)	5	25.00
Medium (17-33)	13	65.00
High (33-90)	2	10.00

The findings revealed that 65.00 per cent had medium adoption with respect to area adopted, whereas 25.00 per cent of the respondents had low and 10.00 per cent had high extent of adoption of direct seeded rice.

**Extent of adoption of zero tillage wheat**

Data regarding extent of adoption of zero tillage in wheat is placed in Table 4. Data clearly indicates that about 43.00 per cent had medium category with respect to area adopted in zero tillage wheat technology, whereas about 38 per cent of the respondents had low and 19.05 per cent had high extent of adoption.

**Table 4: Distribution of the respondents according to extent of adoption for zero tillage in wheat**

(n=21)		
Extent of adoption (Scores)	Frequency	Percentage
Low (up to 18)	8	38.09
Medium (18-39)	9	42.86
High (39-100)	4	19.05

**Extent of adoption of laser leveler**

Extent of adoption of the respondents was measured in term of proportion of area under recommended practice of laser leveler. Findings revealed that 75.00 per cent had high adoption with respect to area adopted, whereas 18.10 per cent of the respondents had medium and about seven per cent had low adoption. So it was concluded that two third of the respondents had adopted laser leveler technology. It may be due to the reason that leveled land may have saving of resources of farmers (Table 5).

**Table 5: Distribution of the respondents according to extent of adoption for laser leveler**

(n=116)		
Extent of adoption (Scores)	Frequency	Percentage
Low (below 66)	8	6.90
Medium (66-89)	21	18.10
High (89-100)	87	75.00

**Extent of Adoption of Selected Recommended Practices of Direct Seeded Rice**

**Seed rate**

According to the Package of Practices for *Kharif* crop, recommended seed rate of 8-10 kg/acre should be used (Anonymous 2015c). From the respondents who adopted DSR practice, 80 per cent respondents had used

recommended seed rate and about 20 per cent of the respondent had used non recommended seed rate. Data indicate that the more than 87 per cent area under recommended seed rate and about 13 per cent area under non recommended seed rate.

**Variety**

For direct seeding of rice, PR 115 is the most suitable variety. From the respondents who adopted DSR practice, 85 per cent respondents had used recommended varieties of PAU and 15 per cent respondents had used non recommended varieties. Data presented in the Table 6 also indicate about area under varieties. More than 88 per cent area was under recommended varieties and 11.54 per cent area was under non recommended varieties.

**Seed treatment**

Seed treatment is performed for many purposes such as to break the dormancy of the seed, to avoid the decaying effect and also to protect the seed from fungal and bacterial diseases. Selected seed should be soaked in 10 litres of water containing 20 g Bavistin 50 WP (carbendazim) and 1g Streptocycline (streptomycin + tetracycline) for 8 to 10 hours before sowing. Data given in Table 6 revealed that all the respondents treated the seed before sowing and all area was under treated seed.

**Herbicides**

Weed control is very crucial practice in DSR as this faces a great problem of weeds. For effective weed control, different herbicides were applied in DSR.

**Pre-emergence herbicide**

According to Package of Practices for *Kharif* crop, Stomp 30 EC (pendimethalin) @ 1.0 litre/acre within two days of sowing should be applied for pre emergence weed control (Anonymous 2015c). The results presented in Table 6 showed that 90 per cent respondents used recommended herbicide and 10.00 per cent respondents used non recommended pre emergence herbicide. The dose applied by the respondent was also recorded and data showed that more than 55.00 per cent respondents had used recommended dose and 20.00 per cent respondents had used more than recommended dose. While 15.00 per cent respondents used less than recommended dose. Further, about 95 per cent of the area was under the recommended herbicide but about five per cent area was under non recommended herbicide. Majority of the area (60.26 per cent) was under recommended dose of herbicide. Twenty per cent of respondents used more than recommended dose of herbicide. While 15 per cent of respondent used less than recommended dose on 14 per cent area.

**Post-emergence herbicide**

Herbicides which are applied in standing crop are spraying at 3-4 leaf stages of the weed called post emergence herbicides. When the crop is infested with *swank* and paddy *mothas*, Nominee Gold/Taarak/Wash out/Macho10 SC (bispyribac) 100 ml per acre should be applied. Segment 50 DF (azimsulfuron) at 16 g per acre should be applied, when the crop is infested with paddy

**Table 6: Distribution of respondents according to their extent of adoption of selected recommended practices of direct seeded rice**

		(n=20; Area= 78 acre)	
Practices		Frequency	Area (Acres)
<b>Seed rate</b>			
a)	Recommended	16 (80)	68 (87.18)
b)	Non recommended	4 (20)	10 (12.82)
<b>Variety</b>			
a)	Recommended	17 (85)	69(88.46)
b)	Non recommended	3 (15)	9(11.54)
<b>Seed treatment</b>			
a)	Treated	20 (100)	78 (100)
b)	Not treated	–	–
<b>Pre emergence Herbicide</b>			
a)	Applied	20 (100)	78 (100)
b)	Not applied	–	–
<b>• Chemical used</b>			
a)	Recommended	18 (90.00)	74 (94.87)
b)	Non recommended	2 (10.00)	4 (5.13)
<b>• Dose applied</b>			
More than recommended		4 (20.00)	16 (20.51)
a)	Recommended	11 (55.00)	47 (60.26)
b)	Less than recommended	3 (15.00)	11 (14.10)
<b>Post emergence Herbicide</b>			
a)	Applied	20 (100)	78 (100)
b)	Not applied	–	–
<b>• Chemical used</b>			
a)	Recommended	20 (100)	78 (100)
b)	Non recommended	–	–
<b>• Dose applied</b>			
a)	More than recommended	9(45.00)	52 (66.67)
b)	Recommended	7(35.00)	15 (19.23)
c)	Less than recommended	4(20.00)	11 (14.10)
<b>Fertilizer used</b>			
<b>Nitrogenous</b>			
a)	Less than recommended	2 (10.00)	3 (3.85)
b)	Recommended	2 (10.00)	5 (6.41)
c)	More than recommended	16 (80.00)	70 (89.74)
<b>Phosphatic</b>			
a)	Applied	7 (35.00)	14 (14.29)
b)	Not applied	13(65.00)	84 (85.71)
<b>Potassic</b>			
a)	Applied	2 (10.00)	7 (8.97)
b)	Not applied	18 (90.00)	71(91.02)

Figures in parentheses indicate percentages

*mothas* including *gandi wala motha* (*Cyperus rotundus*) and broadleaf weed at 20–25 days after sowing in 150 litres of water. Data given in Table 6 revealed that all respondents applied recommended post emergence herbicides. But the dose of herbicides varied from recommend to more than recommend and less than recommended.

Forty five per cent of the respondents had applied more than recommended dose of post emergence herbicides and about 35 per cent respondents had

applied recommended dose of post emergence herbicides. But 20 per cent respondents had applied less than recommended dose of post emergence herbicides. All of the area was under the recommended post emergence herbicide. About 45 per cent of the respondents had 66.67 per cent area under more than recommended dose of herbicides and 19.23 per cent area under recommended dose of herbicides. But about 14.00 per cent area was under less than recommended dose of herbicides.

**Fertilizers used**

According to Package of Practices for *Kharif* crop, 60 kg nitrogen (130 kg Urea) per acre after sowing should be applied in three equal splits at two, five and nine weeks (Anonymous 2015c). The data presented in Table 6 revealed that all the respondents applied nitrogenous fertilizer and majority of the respondents (80.00 per cent) had used more than recommended dose on 89.74 per cent area. About 10 per cent respondents had applied recommended dose of urea on 6.41 per cent area and 10.00 per cent respondents applied less than recommended dose of urea on 3.85 per cent area. When DSR was sown after wheat grown with recommended phosphorus then phosphorus application should be skip. But data showed that about 35 per cent respondents still applied DAP on 14.29 per cent area and 65.00 per cent respondents had not applied DAP on 85.71 per cent area. Application of Potash fertilizer should be done on soil test basis, but data showed that about 10 per cent respondents had applied potash on their field and 8.97 per cent area

was under the potassic fertilizer.

**Extent of Adoption of Zero Tillage Wheat Variety**

All the varieties which were recommended for conventional sowing of wheat such as HD 3086, HD 2967, PBW 677 and PBW 550 etc, were also recommended for zero tillage in wheat. All the respondents had used recommended varieties under zero tillage cultivation.

**Seed rate**

Seed rate with recommended amount is essential for securing good yield. Seed rate of 45 kg per acre for PBW 550 and 40 kg per acre for all other recommended varieties should be used. Data in Table 7 revealed that majority of the respondents (57.14 per cent) had used recommended seed rate. About 43 per cent respondents used non-recommended seed rate at their fields which comprised major area (55.10 per cent) area out of total area.

In termite infested soil, seed should be treated with

**Table 7: Distribution of respondents according to their extent of adoption of selected recommended practices of zero tillage wheat**

Practice		Frequency	Area acres
(n=21 Area 98 acre)			
<b>Variety</b>			
a)	Recommended	21 (100)	98 (100)
b)	Non recommended	–	–
<b>Seed rate</b>			
a)	Recommended	12 (57.14)	44 (44.90)
b)	Non recommended	9 (42.86)	54 (55.10)
<b>Seed treatment</b>			
a)	Treated	8 (38.09)	58 (59.18)
b)	Not treated	13 (61.90)	40 (40.82)
<b>Pre emergence Herbicide</b>			
a)	Applied	0	0
<b>Post emergence Herbicide</b>			
a)	Applied	21 (100)	98 (100)
b)	Not applied	–	–
<b>Chemical used</b>			
a)	Recommended	21 (100)	98 (100)
b)	Non recommended	–	–
<b>Dose applied</b>			
a)	More than recommended	7 (33.33)	41 (41.84)
b)	Recommended	9 (42.86)	33 (33.67)
c)	Less than recommended	5 (23.81)	24 (24.49)
<b>Fertilizer used</b>			
<b>Nitrogenous</b>			
a)	Less than recommended	4 (19.05)	14 (14.29)
b)	Recommended	17 (80.95)	84 (85.71)
c)	More than recommended	–	–
<b>Phosphatic</b>			
a)	Less than recommended	7 (33.33)	40 (40.82)
b)	Recommended	6 (28.57)	23 (23.47)
c)	More than recommended	8 (38.09)	35 (35.71)

Figures in parentheses indicate percentages

4ml Dursban/Ruban/Durmet 20 EC (chlorpyrifos) or 6 ml Regent 5per cent SC (fipronil) per kg seed, dry the seed in shade and then treat the seed of all varieties except that of WHD 943, PDW 291, PDW 233 with Vitavax Power 75 WS @ 3g/kg (300 g/quintal) or Vitavax @2g/kg (200g/quintal) or Raxil @1g/kg (100g/ quintal) or Bavistin/Agrozim/Derosal/JK Stein/Sten 50/Provax/Bencor @2.5g/kg (250 g/quintal) seed for the control of loose smut. Seed should be treated with Captan or Thiram @ 3g/kg (300g/quintal) if the seed is infected with black tip and head scab. Data presented in Table 7 discloses that majority of ZTW adopters (61.90per cent) had not treated the seed and about 41 per cent area was under non treated seed. Thirty eight per cent respondents had treated the seed and hence 59.18 per cent area was under treated seed.

#### Use of herbicide in zero tillage wheat

When wheat is growing without any preparatory tillage, if the field infested with weeds, then spraying of half litres of Gramoxone (Paraquat) in 200 litres of water should be used before sowing. But according to data in Table 7 espondents were not applying any herbicide. This may be due to the reason that they were not facing problem of weeds at the time of crop sown.

#### Post emergence herbicide

Any of post murgence herbicide, isoproturon 75 WP @300g/acre, clodinafop 15 Wp (Topic, Rakshak Plus) 160g/acre, Sulfosulforon 75 WG (leader) 13g/acre, pinoxaden 5 EC @ 400ml/acre or fenoxaprop-p-ethyl 10 EC @13g/acre should be applied. Data given in Table 7 show that all the respondents applied recommended post emergence herbicide. But the dose of herbicides varied from recommended to more than recommended and less than recommended. Majority of the respondents (42.86per cent) had applied recommended dose of herbicides on 33.67 per cent area. About 34.00 per cent respondents had applied more than recommended dose of herbicide on an area of about 42 per cent. About 24 per cent respondents had applied less than recommended dose of herbicides on 24.49 per cent area.

#### Fertilizers used

The fertilizers should be applied on the soil test basis. In the zero tillage wheat Urea and DAP should be applied with the dose of 110 and 55 kg respectively. Data revealed that all the respondents applied nitrogenous fertilizer but varied with their dose application. Majority of the respondents (80.95 per cent) applied more than recommended dose of urea on 85.71 per cent area. More than 19 per cent respondents had applied recommended dose of urea on 14.29 per cent area. Phosphatic fertilizer dose also varied about 39 per cent of the respondents had applied more than recommended dose of DAP on 35.71 per cent area. About 34.00 per cent respondents applied less than recommended dose of DAP on 41 per cent area. But about 29 per cent respondents had applied

recommended dose of DAP on 23.47 per cent area.

#### Gap between Two Subsequent Laser Leveling

Laser land leveller is used for precise land levelling to enhance the farm water use efficiency and other farm inputs in field. There is no recommendation between two subsequent laser levelling.

So, it depends upon the nature of soil and crops. Data presented in Table 8 revealed that about 32 per cent respondents had used laser leveller after one year whereas 51.38 per cent used after two years, while 17.43 per cent respondents made three or more years gap between two subsequent laser levelling. The remaining number of adopter had started use of this technology in the year 2015.

**Table 8: Distribution of respondents according to gap between two subsequent laser levelling**

(n=109)		
Gap	Frequency (f)	Percentage
One year	35	32.11
Two year	56	51.38
Three year or more	19	17.43

#### CONCLUSIONS

Majority of the farmers had applied more than recommended dose of nitrogenous fertilizer as revealed by this study. So, demonstrations at local level should be organized to convince the farmers to apply recommended dose of fertilizers. Farmers had not applied pre sowing herbicide in zero tillage in wheat; hence they may be educated on this aspect. There was no adoption of tensiometer by the farmers at all. So efforts should be made for popularizing this technology. Whereas for bringing maximum area under adoption more number of direct seeding of rice and zero till drills should be provided to farmers by government at custom hiring and subsidy should be given to farmers on purchasing of machinery.

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## **Dissemination and Utilization of Market Information System by Farmers and Traders for Maize Crop in Haryana**

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### **ABSTRACT**

*The present study was conducted in Ambala district of Haryana covering Naraingarh and Shahzadpur block which were selected purposively on the basis of maximum production under maize crop. Further, Ambala city, Mullana, Naraingarh and Shahzadpur markets were selected for the market study. Finally, 60 farmers were randomly selected from these two blocks and 40 traders from four regulated markets of Ambala district were selected. From the findings of the research study in Ambala district farmers, awareness on prices and arrivals were of I-Rank and II-Rank in MIS Adopters and Non Adopters farmers awareness on price in reference and other market were in I-Rank and II-Rank. The daily prices were compiled manually and written on the notices board for the use of the farmers visiting the market. The information is disseminated through various media like neighbors, newspapers, relatives etc. The utility of market information was low among the farmers as compared to traders. About 91.7% of farmers expressed that market information was not available in required form in Ambala district. Farmers have also faced difficulty on accessibility aspects (73.3 per cent).*

### **Keyword**

Dissemination, marketing information system, utilization

### **JEL Codes**

C81, M31, Q13, Q18

### **INTRODUCTION**

Marketing Information System has been seen as a support system for the firms' marketing management with its decision making process; in addition, to the management perspective, marketing information system can be an essential tool for the entire market organization. Marketing Information Systems as an interacting structure of people, equipments and procedures to gather sort, analyze, evaluate and distribute, timely and right information for use by proper marketing decision makers to improve their marketing design, implementation, and control (Kotler & Keller 2012). Market intelligence system is a set of measures and sources used by managers to obtain their day by day information about related developments in the marketing environment (Kotler & Armstrong, 2010). Information is critical to the social and economic activities that complete the development process. Developing economy has witnessed agricultural (green, white, yellow, blue and now rainbow), industrial and information technology revolutions. The

Government of India has given more thrust on food and agriculture, information technology sectors towards success of economic reforms for achieving high growth rate in production (Rajendran & Karthikesan, 2014). Maize was in cultivation in eastern Haryana three decades ago, its area shifted to rice cultivation owing to improved irrigation facility. In the light of the heredecline of groundwater, the unbeneficial rice cultivation could give way to maize cultivation since it can be managed with light irrigations. Being close to the National Capital region, there is an opportunity to grow specialty corns, such as baby corn, sweet corn, popcorn, green cobs and quality protein maize for poultry feed. The state has the difference of having the country first maize based starch industry. Maize is grown, currently, in an area of 8 thousand ha, with production of 18 thousand tones and productivity 22250 Kg/ha during 2014-2015. Maize (*Zea mays* L.) is one of the most resourceful emerging crops having wider adaptability under varied agro-climatic conditions. In India, maize is the third mainly significant

food crops after rice and wheat. Globally, maize is known as queen of cereals because it has the highest genetic yield potential among the cereals. The United States of America (USA) is the main producer of maize contributes nearly 35 per cent of the total production in the world and maize is the driver of the US economy. The specific objectives of the study are as follows:

- 1 to study the existing market information system for maize crop of Ambala in Haryana,
- 2 to study the pattern and extent of dissemination and utilization of existing formal information by stakeholders, and
- 3 to identify the constraints in the existing formal information system and suggest alternatives.

### METHODOLOGY

The primary data were collected by personal interview method by using pre-tested structured schedule prepared for the purpose. Ambala district was purposively selected due to maximum production under Maize crop. In Ambala district two blocks (Shahzadpur and Naraingarh) were selected due to the maximum area. From Ambala district four regulated markets (Ambala city, Mullana, Shazadpur, Naraingarh) were selected due to maximum arrivals of Maize. From two blocks four villages i.e. Jatwar, Khowa Khurd, Dera and Khora Bhura (MIS Adopters and Non-Adopters) were randomly selected. Interview method was developed to get complete and reliable information with the help of well-structured schedule. To study the sources of agriculture market information and their utilization among the 60 farmers and 40 traders from village and markets area were selected for the study, based on random sampling technique. The find out nature, extent, sources and utilization of the market information system by farmers and traders, tabular analysis with simple averages,

percentages etc. were computed. The farmers and traders response was scored giving a weight of 3 for 'always', 2 for 'sometime', 1 for 'rarely' and 1 for 'yes' and 0 for 'No'.

### RESULTS AND DISCUSSION

#### Farmers Awareness on Agricultural Market

##### Information System in Ambala district of Haryana

**Awareness of farmers:** Table 1, indicated the awareness of the sample farmers on different components of market information. In Ambala district of farmers, the awareness on prices in other markets was found to be I-Rank and awareness on arrivals in other markets was II-Rank who use MIS Adopters in Ambala district of markets. However, arrivals in reference market were III-Rank and prices in reference market were IV Rank. It is interesting to note that Ambala district of Maize farmers was aware of either area, production, quality of produce to particular crops. In the case of Non Adopters Ambala district of farmers, the extent of awareness on arrivals and prices in reference market was I-Rank and II-Rank and awareness on arrivals was III-Rank and prices in other market was to be found IV-Rank, respectively. It is worth noting but similar pattern follows (MIS adopters and Non-adopters), Ambala district of farmers were aware of parameters like area sown V Rank and quality/grade of produce VI-Rank. Similar findings were also reported by Hatai and Panda (2015).

**Awareness of traders:** It was revealed from the Table 2 that in general, the degree of awareness of market information was found to be high among the sample traders. Among the different components of market information, the awareness on prices in other market formed I-Rank followed by arrivals in other market, arrivals in reference market, and prices in reference market (III-Rank) in Ambala district. It is worth noting that more than 75 percent of traders were aware of arrivals

**Table 1: Farmers awareness on market information in Ambala district for MIS adopters and non-adopters of Haryana**

Type of market information							(N=60)	
	Always		Sometime		Rarely		Total score	Rank
	Score	Percentage	Score	Percentage	Score	Percentage		
<b>Degree of Awareness</b>								
Arrivals in other market	90	50.0	56	46.7	2	3.3	148	II
Arrivals in reference market	81	45.0	66	55.0	0	0.0	147	III
Prices in other market	96	53.3	56	46.7	0	0.0	152	I
Prices in reference market	75	41.7	60	50.0	5	8.3	140	IV
Area under crops	38	21.1	20	16.7	2	3.3	60	V
Quality/ grade required	0	0.0	0	0.0	0	0.0	0.0	VI
<b>Non Adopters</b>								
Arrivals in other market	78	43.3	50	41.7	9	15.0	137	IV
Arrivals in reference market	69	38.3	74	61.7	0	0.0	143	III
Prices in other market	75	41.7	70	58.3	0	0.0	145	II
Prices in reference market	87	48.3	58	48.3	2	3.3	147	I
Area under crops	72	40.0	48	40.0	12	20.0	132	V
Grade/ Standard required	0	0.0	0	0.0	0	0.0	0.0	VI

and prices regularly. Unlike farmers, traders were aware of information on the area under crops and quality/grade aspects of the produce by Ambala district. It was observed that traders were aware of a market information system on the area under crop production of agricultural products. Similar findings were also reported by Hatai and Panda (2015).

**Sources of Market Information of Farmers and Traders**

**Sources of market information of farmers:** Table 3 showed that the sources of market information at village level on arrival information indicated that Neighbors and Newspapers (I Rank) and (II Rank) were the general sources of market information of Ambala district of village farmers. Whereas Relatives and Television (III Rank) and (IV Rank) in Ambala district of villages formed the sources of market information. Neighbor's formed the major source of market information in Ambala district of Villages. The institutional agencies like Gram Panchayat, co-operative credit society and SHG's did provide labor's market information. However, KrishiVigyan Kendra's

(KVKs) were part of market information to farmers at village level. Commission agents are the most sought after market information sources (83.3 per cent), Announcement by APMC (73.3 per cent), Display board/Ticker board (50.0 per cent) in Ambala district of villages at the market level (Table 4). Similar findings were also reported by Amrutha *et al.* (2015).

**Sources of market information of traders:** Table 5, revealed that contacts in other markets and fellow traders formed major sources of market information on arrivals and prices among traders with I and II ranks among different sources of market information. Always more than 70 percent of traders were sourcing their market information through fellow traders and contacts in other markets regularly in Ambala district markets. Newspaper (III-rank) was in Ambala district, display boards in APMC (V-rank) in Ambala district of markets, bulletins of APMC (IV-rank) was in Ambala district of markets, magazines was the other important sources of market information to the traders. Traders did not prefer Government publications, market intelligence cell,

**Table 2: Traders awareness of regulated market information in Ambala district of Haryana**

(N=40)

Type of market information	Degree of Awareness						Total	Rank
	Always		Sometime		Rarely			
	Score	Percentage	Score	Percentage	Score	Percentage		
Arrivals in other market	90	75.0	16	20.0	2	5.0	108	II
Arrivals in reference market	78	65.0	26	32.5	2	5.0	106	III
Prices in other market	105	87.5	8	10.0	1	2.5	114	I
Prices in reference market	78	65.0	26	32.5	2	5.0	106	III
Area under crops	60	47.5	20	25.0	3	7.5	83	IV
Production	75	42.5	20	25.0	5	12.5	100	V
Grade/Standard required	0	0.0	0	0.0	0	0.0	0	VI

**Table 3: Farmers sources of market information at village level in Ambala district of Haryana**

(N=60)

Sources	Degree of Awareness						Total score	Rank
	Always		Sometime		Rarely			
	Score	Percentage	Score	Percentage	Score	Percentage		
Newspaper	87	48.3	54	45.0	4	6.7	145	II
Television	72	40.0	54	45.0	9	15.0	135	IV
Radio	54	30.0	40	33.3	22	36.7	116	V
Gram Panchayat	6	3.33	4	3.33	56	93.3	60	XI
Neighbors	90	50.0	58	48.3	1	1.7	149	I
Relatives	81	45.0	44	36.7	11	18.3	136	III
KVKs	45	25.0	36	30.0	27	45.0	108	VII
Cooperative credit society	39	21.7	40	33.3	27	45.0	106	VIII
SHGS	54	30.0	38	31.7	23	38.3	115	VI
Magazine	30	16.7	36	30.0	32	6.7	98	IX
Internet	27	15.0	24	20.0	39	65.0	90	X

**Table 4: Farmers sources of market information at market level in Ambala district of Haryana**

Source of market information	(N=60)	
	No.	Percentage
Commission agents	50	83.3
Announcement by APMC	44	73.3
Display boards/Ticker boards	30	50.0
Input dealer	28	46.7

internet and television as their source of market information. Similar findings were also reported by Amrutha and Hugar(2009).

**Pattern of Dissemination of Market Information**

**Mode and frequency of dissemination:** The markets resorted to different modes of dissemination of the market information in all the four markets of Ambala district. The market information was transmitted through notice boards, announcements in market yards, fax, phone, AIR, television and newspapers (Table 6). The market information was disseminated daily to the District Information Officer, AIR, newspaper, television, internet and District Statistical Officer. Whereas, it was transmitted to Haryana State Agriculture Marketing Board (HSAMB) on the weekly, monthly and annual basis. Similarly, the market information was also sent to Zilla/Gram Panchayat, Agriculture Research Station and Deputy Commissioner once in a year in the form of annual reports (Table 7). Similar findings were also reported by Amrutha & Hugar(2009).

**Utilization by farmers:** The Table 8 indicated the extent of market information utilized by Ambala district of farmers in decision making. It can be clearly seen that making use of market information on arrivals in decision

**Table 6: Dissemination of market information in Ambala district markets of Haryana**

Mode of dissemination	(N=4)	
	Score	Percentage
Notices board	4	100.0
Announcement	4	100.0
Fax	4	100.0
Telephone	4	100.0
Internet	4	100.0
AIR	4	100.0
Television	4	100.0
Posts	4	100.0
Newspaper	4	100.0

**Table 7: Distribution of market information to different agencies in Ambala district markets of Haryana**

Mode of dissemination	(N=4)	
	Score	Percentage
State Agricultural Marketing Board	4	100.0
Department of Agriculture	4	100.0
District Statistical Offices	4	100.0
Research Station	4	100.0
Newspapers	4	100.0
Gram Panchayat	2	50.0

making on various aspects of farming. However, about 90.0 per cent used the information in deciding the crops to be sown. In case of post harvest technique majority was drying (96.7 per cent) in Ambala district of farmers. Another case in selling decision majority was when to sell (86.6 per cent) in Ambala district of farmers. In case of where to sell (83.3 per cent) in Ambala district used the information on market arrivals, respectively. Similar

**Table 5: Sources of Regulated market information system for trader in Ambala district of Haryana**

Sources	Degree of Awareness							Total score	Rank
	Always		Sometime		Rarely				
	Score	Percentage	Score	Percentage	Score	Percentage			
Newspaper	48	40.0	28	35.0	10	25.0	86	III	
Television	18	15.0	30	37.5	19	47.5	67	VIII	
Radio	15	12.5	12	15.0	29	72.5	56	XI	
Magazine	45	37.5	28	35.0	11	27.5	84	IV	
Internet	27	22.5	12	15.0	25	62.5	64	X	
Fellow traders	96	80.0	12	15.0	2	5.0	110	II	
Contact in other market	102	85.0	12	15.0	0	0.0	114	I	
Announcement by APMC	18	15.0	26	32.5	21	52.5	65	IX	
Govt. publications	3	2.5	10	12.5	27	67.5	40	XII	
Display board in APMC	30	25.0	36	45.0	12	30.0	78	V	
Bulletins by APMC	21	17.5	34	42.5	16	40.0	71	VI	
Market Intelligence Cell	15	12.5	12	15.0	29	72.5	56	XI	
APMC tender data for previous days	24	20.0	24	30.0	20	50.0	68	VII	

findings were also reported by Hatai and Panda (2015). **Pattern of utilization by traders:** Table 9, Indicated that the extent of utilization of agricultural market information by traders for decision making on price to be quoted and the quantity to be purchased, followed by storage

decisions of quantity to be sold and the time of storage. It was clearly seen that the agricultural market information was utilized by traders in deciding the price to be quoted (I-Rank), followed by the quantity to be purchased (II-Rank) in Ambala district and quantity to be a store (III-Rank) in Ambala district. The traders were have utilized market information for making decision on when to sale (IV-Rank), when to store (V-Rank) and (VI-Rank) in Ambala district and followed by quantity to be sold (VI-Rank) in Ambala district. Similar findings were also reported by Hatai and Panda (2015).

**Table 8: Extent of Market Information utilization by farmers in Ambala district of Haryana**

(N=60)

Nature/Types of decision	No.	Percentage
<b>Arrival and price in reference market</b>		
<b>Production decisions</b>		
Crops to be sown	54	90.0
Area to be sown	28	46.7
<b>Selling decisions</b>		
When to sell	52	86.6
Where to sell	50	83.3
Whom to sell	42	70.0
Quantity to sell	40	66.7
<b>Post harvest handling decisions</b>		
Drying	58	96.7
Bagging	38	63.3
Transportation	46	76.7

**Benefits derived from market information by farmers:** Table 10, indicated that the benefits from Ambala district of farmers have derived as per their opinion by utilizing market information. It revealed that farmers were benefited and obtained higher price by utilizing the market information's system. In case of Ambala district of farmers, the market information was used in deciding to drying of producers (76.7 per cent), change of place of sale (70.0 per cent), change of time of sale (60.0 per cent) and by storage (46.7 per cent). Similar findings were also reported by Hatai and Panda (2015).

**Benefits derived from market information by traders:** Table 11, indicated that the benefits from Ambala district of traders have derived as per their opinion by utilizing market information. It revealed that traders were

**Table 9: Nature and Extent of Utilization of market information by traders of Ambala district of Haryana**

(N=40)

Types of utilizations	Degree of usage						Total score	Rank
	Always		Sometime		Rarely			
	Score	Percentage	Score	Percentage	Score	Percentage		
<b>Purchase decisions</b>								
Deciding the price to be quoted	102	85.0	8	10.0	2	5.0	112	I
Deciding the quantity to be purchased	96	80.0	14	17.5	1	2.5	111	II
<b>Storage decisions</b>								
Deciding the necessity of storage	36	30.0	22	27.5	17	42.5	63	VIII
When to store	72	60.0	20	25.0	0	0.0	92	V
Quantity to store	90	75.0	16	20.0	2	5.0	108	III
<b>Selling decisions</b>								
Quantity to be sold	60	50.0	30	37.5	5	12.5	95	VI
Deciding where to sell	60	50.0	24	30.0	8	10.0	92	VII
Deciding whom to sell	27	22.5	20	25.0	21	52.5	68	IX
Deciding when to sell	66	55.0	32	40.0	2	5.0	100	IV
<b>Post purchase handling decisions</b>								
Necessity of processing	0	0.0	0	0.0	40	100.0	40	XII
Deciding handling of the commodity	0	0.0	0	0.0	40	100.0	40	XII
Drying	6	5.0	4	5.0	36	90.0	46	XI
Grading	0	0.0	40	50.0	20	50.0	40	XII
Transportation	0	0.0	20	25.0	30	75.0	50	X

**Table 10: Benefits derived from market information by farmers in Ambala district of Haryana**

(N=60)		
Types of Benefits	No.	Percentage
By changing place of sale	42	70.0
Changing time of sale	36	60.0
Drying of produce	46	76.7
By storage	28	46.7
By change of mode of transportation	24	40.0
By better mode of packaging	24	40.0

**Table 11: Benefits derived from agricultural market information by traders in Ambala district of Haryana**

(N=40)		
Types of Benefits from market information system	No.	Percentage
Changing place of sale	30	75.0
Changing time of sale	34	85.0
Changing post harvest handling	16	40.0
Drying of produce	26	65.0
Mode of packing	16	40.0
Mode of storage	28	70.0
Changing quantity of sale	18	45.0
Changing buyer	12	30.0

benefited and obtained higher price by utilizing the market information's system. It was observed that traders were most benefited by changing time of sale (85.0 per cent), followed by changing the place of sale (75.0 per cent), followed by mode of storage (70.0 per cent), followed by drying of produce (65.0 per cent) in Ambala district of markets. Similar findings were also reported by Hatai and Panda (2015).

**Constraints, Expectations and Suggestions of Stakeholder on Market Information's**

**Constraints faced by farmers:** The constraints as perceived by traders in the existing market information are presented in Table 12. About (91.7 per cent) of farmers expressed that market information was not available in required form in Ambala district. Farmers were also faced difficulty on accessibility aspects (73.3 per cent), followed by high transportation cost aspect (70.0 per cent), followed by non-availability of required information on price/prices in other markets/ production aspect (63.3 per cent), followed by better marketing facilities and warehousing facilities aspect (40.0 per cent), followed by Non-availability in time aspect (50.0 per cent) in Ambaladistrict. Similar findings were also reported by Sankar & Singh (2014)

**Constraints faced by traders:** The constraints as perceived by traders were presented in Table 13. About (80.0 per cent) of farmers expressed that market information was not available in required form in Ambala,

**Table 12: Constraints as perceived by farmers in existing Agriculture Marketing Information's of Ambala district of Haryana**

(N=60)		
Constraints	No.	Percentage
Accessibility	44	73.3
Costly	6	10.0
Non-availability in time	30	50.0
Non-availability of required information on price/ price in other markets/ arrival/ area/ production	38	63.3
Non-availability of information in required form	55	91.7
Face to high transportation costs	42	70.0
Better Marketing facilities and warehousing facilities	24	40.0

**Table 13: Constraints as perceived by traders in existing Agriculture Marketing Information's of Ambala district of Haryana**

(N=40)		
Constraints	No.	Percentage
Information available but not accessible	12	30.0
Costly	8	20.0
Non-availability in time	22	55.0
Non-availability of required information on price/ price in other markets/ arrival/ area/ production	26	65.0
Non-availability of information in required form	32	80.0
Inadequate Network for Information flow	18	45.0
Lack of information is an barrier production and traders	14	35.0
Lack of Proper dissemination of Market Intelligence through communication	12	30.0

district. Traders were also faced difficulty on non-availability of required information on price/prices in other markets/production aspect (65.0 per cent), followed by Non-availability in time aspect (55.0 per cent), followed by accessibility aspects (30.0 per cent), followed by Inadequate network system aspect (45.0 per cent), followed by followed by lack of information in an barrier production aspect (35.0 per cent), followed by lack of proper dissemination of market Intelligence through communication (30.0 per cent) in Ambala district. Similar findings were also reported by Sankar & Singh (2014)

**CONCLUSIONS**

Based on following finding of the study for improving the agricultural marketing information system in Ambala

district of Haryana. Awareness of farmers on different components of market information was very poor as compared to the awareness of traders in Ambala district. None of the selected district farmers was aware of either area, production, quality of produce or scientific post harvest handling of the produce. Unlike farmers, traders were aware of information on these aspects besides details of the produce in Ambala district markets. Farmer's sources of market information at village level, neighbors and newspapers were the main source of market information to the farmers whereas, commission agents were the most sought source at the market level. Some of the Ambala district farmers also relied on magazines and internet as their sources of market information. Besides a very few farmers also depended on the announcements and display boards at the market. Contacts in other markets and fellow traders were the major source of the market information to the traders of selected district markets. The modes of dissemination of market information were the traditional announcements, display boards, transmission through television and newspapers of Ambala district markets. The utility of market information was low among the farmers as compared to traders. The benefit derived in the form of higher price by traders was relatively more when compared to benefits derived by farmers of Ambala district markets. Non availability of real information on prices was the major constraint as opined by farmers. Whereas the traders opined that they had difficulty in obtaining the information in the required form. The

markets were facing the constraint of inadequate personnel of Ambala district markets. The MIS should be deliver fast, reliable and accurate information in a user friendly manner for utilization by the farmers and other stakeholders in order to facilitate the farmers to decide what and when make crop and marketing planning, how to cultivate, when and how to harvest, what post harvest management practices to follow, when, where, how to sell etc. of the agricultural produce in the study area.

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## Market Information System in Regulated Markets of Haryana

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### ABSTRACT

The study was conducted in the state of Haryana in 2014-15 to study the various market news and information services made available by market committees of the state and to know their effective utilization by farmers. Six regulated markets namely Sirsa, Ratia, Kaithal, Karnal, Rohtak and Hodal were selected for the purpose, two from each of the 3 zonal administrations of the Haryana State Agricultural Marketing Board. The responses of 120 farmers were secured from each selected market through pretested questionnaire to test the effective utilization of these services. It came to light that none of the markets except Sirsa had adequate infrastructure in place to disseminate market news to the farmers. The awareness percentages for Notice Board, Ticker Board, Agri Business Information Centre, Library and AGMARKNET were 45.8, 16.6, 4.1, 0 and 0.8 respectively. The percentage of farmers who found these facilities useful was even lower. Out of all the information sources, farmers also ranked commission agents, fellow farmers, newspapers, village traders as 1st, 2nd, 3rd and 4th respectively for their reliability for getting market related information. The results clearly showed the neglected state of such an important aspect of agricultural produce marketing. The study recommended that the market committees should increase the number of notice boards and primarily work towards making the farmers aware of the various sources of information already available to them such as ABIC, Library, AGMARKNET. Also, farmers opined to get prices, arrivals and various schemes related information through SMS.

### Keywords

Haryana, market information, regulated market, utilization

### JEL Codes

C81, D43, Q13

### INTRODUCTION

In India, agriculture is of astronomical importance to people and to the nation. It contributes 13.7 per cent in the gross domestic product (GDP) of the country and employs 52.1 per cent of the population directly or indirectly. Hence, the economic situation of the country is affected by agricultural production and in today's market driven economy marketing is as essential as production. One of the main motives of agricultural produce marketing regulation programme was to enable farmers to fetch remunerative price for their produce. In such a situation the importance of timely, accurate and adequate market news and information cannot be denied. It can help the farmers plan and alter their cropping programme, harvesting and storage decisions. NICNET based Agricultural Marketing Information Network developed with a view to provide to electronic connectivity to all 2700 important wholesale markets in the country a Marketing Information Network Scheme viz.

'AGMARKNET'. The scheme launched in 2000-01 was to collect and disseminate (price and market related (accepted standards of grades, labeling, sanitary and phyto-sanitary requirements) information in respect of agricultural commodities (Suri, 2005). The benefits of timely, adequate and accurate market information were also emphasized by Adhiguru *et al.* (2009). The results clearly showed farmers who had a higher adoption of market information systems were actually progressive ones. Other farmers were majoritarily dependent on these progressive farmers and input dealers for market information. Adoption rates also differ within farmers as only 4.8 per cent of the small farmers had access to public extension workers as compared to 12.4 per cent of large farmers. The public extension system had been found to be accessed by only 5.7 per cent households. The types of information pertaining to markets as desired by farmers were mainly of prices and arrivals. Also, according to a study in Assam covering maowing and garobadha

regulated markets the farmers were unable to evaluate and document the agricultural market information due to illiteracy and poor communication ability (Hatai, 2015). So there are multiple aspects of an efficient marketing i.e. an efficient system that collects, assembles, tabulates thus making the data comprehensible, disseminating the data into farmer centric information channels in a timely manner alongwith a recipient that can comprehend the information for his benefits. Here farmer literacy plays an important role to make this system truly successful. One other aspect that plays important role is the power of information system once it is accepted by farmers. The increase in information availability affects information seeking behaviour. The difference is most significant in the areas which are directly related to the market. The beginning of this behavior development process begins from simple services like SMS (Rai *et al.*, 2014). Due to non availability of market information majority of farmers turn to 'hatts' or weekly markets where they are cheated by organized group of traders (Barman *et al.*, 2004). There are some examples of government efforts leading to successful results by turning farmers' reliable information priority sources from unorganized to organized ones. In Indonesia the Ministry of Agriculture provides 3 level prices information on vegetables, fruits and secondary crops in all the provinces through dedicated market information system. Due to the development of market information network Radio, TV, marketing board's notice boards were ranked 3rd, 4th and 5th respectively in terms of reliability of information (Rana & Astuti, 2003). Still it is a big challenge to bring the organized sources to top place in farmer's priority list. As in China there are several agencies such as National Grain and Oil Information Center, Grain Information Web, Agriculture Ministry Information Centre etc involved in collecting and disseminating information such as wholesale price, retailing price, producer's quotation, platform price and port price on rice, wheat, corn and soyabean, etc. on majority of crops to farmers, national and international organizations as well. Despite all the credible sources available the study revealed that majority of farmers in China considered information from co-operatives as most important and major source for information for them was fellow farmers (Bo & Bu, 2003). Considering all these aspects indicating the prominent place of market news and information system the study with following specific objectives was carried out.

1. to study the present status of market news and information system and check its utilization among farmers and
2. to check the dependence of farmers on different sources of market information.

## **METHODOLOGY**

The study was confined to regulated markets of Haryana state. To get the adequate representation of the study area the Haryana state was divided into three zones

as per the existing three zonal administrations of Haryana State Agricultural Marketing Board at Hisar, Karnal and Gurgaon. Top two markets from each zone were selected based on total arrivals of Wheat and Paddy for the last five years collectively. Thus, in all six markets were selected from three zones, from Sirsa zone, Sirsa and Ratia, from Karnal zone, Kaithal and Karnal and from Guragon zone Rohtak and Hodal were selected. Both primary as well as secondary data was collected for the purpose. Secondary data pertaining to present status of market information facilities was collected from respective market committee records and from agri-business information officers wherever available. For collection of primary data out of farmers selling their produce in the market yard, 20 farmers from each market yard were selected randomly. Thus, in all 120 farmers were selected from all the six markets. To capture the responses of farmers a pretested questionnaire (tested in Hisar market yard) was used. To find out actual sources, utilization, reliability of market information by farmers, tabular analysis with simple averages, percentages etc. were computed

## **RESULTS AND DISCUSSION**

### **Market News and Information Services in Selected Market Yards and Their Utilization**

The assessment of market news and information services provided by respective market committees revealed that condition of notice boards maintained by respective committees was very poor, The responsible factors were their inadequate numbers, improper location, no regular updating. The number of notice boards was drastically low in all markets except Karnal market. Ticker boards were only functional in Sirsa and Hodal market that too were located inside market committee offices. Awareness about AGMARKNET among famers was found to be near nil because of all 120 respondent farmers only 1 farmer from Sirsa market knew of the facility available to them. Facilities such as Toll free no. , SMS service was also not provided by any of the market committees. Condition of ABIC's was also very poor as it was not even provided in Kaithal market and of all other markets where it was provided only 5 respondents out of 100 knew of their existence in the market yard. Only in Sirsa market Library was found to be in good condition but libraries also faced a similar problem of no awareness about it among farmers.

#### **Market Yard 'Ratia'**

Information collected from Ratia market depicted in Table 1 revealed that, the condition of market news and information services was below par as services like loudspeaker, library and newspapers, SMS, toll free number were not available. Of the facilities available ticker board was found non functional. Awareness among farmers about the services available was worse as only 25 per cent were aware of the notice boards. ABIC was situated in the kisan rest house and probably due to its location none of the farmers were aware of its presence.

#### **Market Yard 'Sirsa'**

The data pertaining to Sirsa market showed the presence of 2 notice boards, 1 ticker board, ABIC, library with newspaper facility, all of them in working condition. However no toll free number or SMS service was being rendered by the committee. All the services that were provided were found to be actually functioning. But, the awareness about these services was not enough to regard them successful as only 55, 25, 5, 0, 5, and 5 per cent of farmers were aware of the existence of notice boards, ticker boards, ABIC, library, newspapers and AGMARKNET respectively as presented in Table 2.

**Market Yard' Kaithal'**

In market yard Kaithal the job of market news and

information dissemination was being carried with the help of only 5 working notice boards and 3 private loudspeaker units installed by arhtia association. Daily reporting of prices on AGMARKNET was however done on daily basis without delay. Toll free number, SMS service, ABIC, library, ticker board, newspaper facilities were not provided to farmers by the market committee. It was noticed that 85 per cent of the farmers were aware of notice boards location in the market primarily due to their precise location on gates. But none of the respondents had ever heard of AGMARKNET and it use. The status is presented in Table 3.

**Market Yard 'Karnal'**

**Table 1: Market news and intelligence facilities in Ratia market yard**

(N=20)

Sources of information	Available (Yes/No)	Number/condition	Awareness (Per cent)
Notice board (Soochnapatt)	Yes	1/Working	25
Ticker board	Yes	1/Not working	0
Loudspeaker	No		
ABIC	Yes	Working	0
Library	No		
Newspaper	No		
AGMARKNET (Daily price reporting)	Yes	Working	0
Toll free No.	No		
SMS service	No		

**Table 2: Market news and intelligence facilities in Sirsa market yard**

(N=20)

Sources of information	Available (Yes/No)	Number/condition	Awareness (Per cent)
Notice board (Soochnapatt)	Yes	2/Working	55
Ticker board	Yes	1/Working	25
Loudspeaker	No		
ABIC	Yes	Working	5
Library	Yes	Working	0
Newspaper	Yes	3	5
AGMARKNET (Daily price reporting)	Yes	Working	5
Toll free No.	No		
SMS service	No		

**Table 3: Market news and intelligence facilities in Kaithal market yard**

(N=20)

Sources of information	Available (Yes/No)	Number/condition	Awareness (Per cent)
Notice board (Soochnapatt)	Yes	7 (5 Working)	85
Ticker board	No		
Loudspeaker	No	Private	
ABIC	No		
Library	No		
Newspaper	No		
AGMARKNET (Daily price reporting)	Yes	Working	0
Toll free No.	No		
SMS service	No		

As per stats in Table 4 the presence of notice boards was highest in Karnal market with 16 of them installed at gates and other important places. But, only 50 per cent of them were actually functioning. Ticker boards and library were present but were not under use. The awareness among farmers however was even worse as the data collected showed awareness among farmers was only 50, 33.3, and 33.3 per cent awareness about notice boards, ticker boards and news papers respectively. AGMARKNET suffered the same fate of unawareness among farmers in Karnal also.

**Market Yard 'Rohtak'**

Data in Table 5 reveals that the status of market news

services in Rohtak market was undeniably poor considering the scale of investments made in all other sorts of infrastructure projects. The market committee had provided only 1 notice board for a market of approx. 93 acres. Eventually, awareness about its presence was found to be only 10 per cent. Daily price reporting on AGMARKNET was done and ABIC was also present in the yard but Agri-business information officer was not approachable even after requests. Services such as SMS, toll free number, loudspeaker, newspapers did not exist at all. Ticker board and library were present but were non functional. Awareness stats showed much worse picture as 10, 20, and 0 per cent farmers were aware of ticker

**Table 4: Market news and intelligence facilities in Karnal market yard**

(N=20)

Sources of information	Available (Yes/No)	Number/condition	Awareness (Per cent)
Notice board (Soochnapatt)	Yes	16 (8 Working)	50
Ticker board	Yes	2/Not working	33.3
Loudspeaker	No		
ABIC	Yes	Working	0
Library	Yes	Not working	0
Newspaper	Yes	1	33.3
AGMARKNET (Daily price reporting)	Yes	Working	0
Toll free No.	No		
SMS service	No		

**Table 5: Market news and intelligence facilities in Rohtak market yard**

(N=20)

Sources of information	Available (Yes/No)	Number/condition	Awareness (Per cent)
Notice board (Soochnapatt)	Yes	1 Working	10
Ticker board	Yes	1/Not working	10
Loudspeaker	No		
ABIC	Yes	Working	20
Library	Yes	Not working	0
Newspaper	No		
AGMARKNET (Daily price reporting)	Yes	Working	0
Toll free No.	No		
SMS service	No		

**Table 6: Market news and intelligence facilities in Hodal market yard**

(N=20)

Sources of information	Available (Yes/No)	Number/condition	Awareness (Per cent)
Notice board (Soochnapatt)	Yes	2 Working	50
Ticker board	Yes	1/Not working	35
Loudspeaker	No	Private	
ABIC	Yes	Working	
Library	No		
Newspaper	No		
AGMARKNET (Daily price reporting)	Yes	Working	0
Toll free No.	No		
SMS service	No		

boards, ABIC and library existence.

#### Market Yard 'Hodal'

The information collected from Hodal market presented in Table 6 shows that only 2 working notice boards, 1 working ticker board and a private loudspeakers carried out the news dissemination job of market committee. Daily price reporting on AGARKNET was done without failure and ABIC was also present and functional. But no library, newspapers, toll free number, SMS services were present in the yard.

The collective scenario of the news and information facilities showed a drastic and neglected condition of this important part of marketing. Even if the facility has been provided, there was very low awareness about their existence among farmers. It clearly shows that the importance and power of correct, timely and adequate market news and information has not been recognized by the market committees.

#### Utilization of Market News and Intelligence Services in All Market Yards

The utilization of the market news and information services by farmers who were aware of their presence was

also very less. Only 21 out of 55 aware farmers found notice boards useful that is, 17.5 per cent of total respondents. Only 8 out of 120 farmers found the ticker boards useful (6.6 per cent). The presence of ABIC served no help to the farmers as only 2.5 per cent found it useful. The condition of rest of the sources was found to be much worse as depicted in the Table 7.

#### Reliability Ranking of Sources of Market News for Farmers Collectively for all Selected Market Yards

The Table 8 indicates the clear dependency of farmers on unorganized sources for information related to markets. Also, it reveals that various efforts made by Governments HSAMB, Market committees to provide farmers legitimate sources of information have lead to nothing. The collective results ranked commission agent, fellow farmers, newspapers, village traders as 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> respectively. Commission agents were declared first priority source by 58 respondents, fellow farmers were favoured by 41 respondents, village trader by 12 respondents and only 9 respondents chose newspapers as first priority source. None of the farmers relied at any level on ABIC, ticker boards, loudspeakers, library, Toll

**Table 7: Utilization of market news and intelligence services**

(N=120)

Sources of information	No. of farmers aware	Awareness	No. of farmers who find the facility useful	Usefulness (Per cent)
Notice board (Soochnapatt)	55	45.8	21	17.5
Ticker board	20	16.6	8	6.6
ABIC	5	4.1	3	2.5
Newspapers	7	5.8	5	4.1
AGMARKNET	1	0.8	1	0.8

**Table 8: Reliability ranking of sources of market information**

(N=120)

Sources of information	1 <sup>st</sup> priority votes	2 <sup>nd</sup> priority votes	3 <sup>rd</sup> priority votes	Final reliability ranking
Notice board (Soochnapatt)	–	4	13	5
Ticker board	–	–	–	–
Loudspeaker	–	–	–	–
ABIC	–	–	–	–
Library	–	–	–	–
Newspaper	9	16	22	3
AGMARKNET	–	–	–	–
Toll free No.	–	–	–	–
SMS service	–	–	–	–
Radio/TV	–	–	–	–
Fellow farmer	41	48	23	2
Commission agent	58	39	42	1
Village trader	12	13	20	4

free no., SMS services and AGMARKNET for market oriented news or information.

**Market Information Desired by Farmers through SMS**

The respondents when asked of the type of information desired by them through SMS service related to markets, 95 per cent of them pointed towards information on prevailing prices only. Apart from that, farmers also wanted to have information on various schemes being put forth by HSAMB or market committees in advance. 28 farmers pointed out to get the information on arrivals in the very market yard and neighboring markets so that they could plan of selling at some other day. It was observed that due to lack of business minded nature of farmers they were found to be unaware of how they could utilize market intelligence services such as price forecasts to plan their produce. The stats are shown in Table 9.

**Problems Regarding Optimization of Market Information**

As per the data collected from 120 farmers and presented in Table 10 to find out the problems faced by farmers in comprehending market information, it was found that only 65 per cent were found to be able to read, 88 per cent of farmers desired that SMS should be delivered in Hindi. Among all the respondents only 18 per cent of them agreed to pay nominal fees for the service and rest insisted on it be provided free of cost. Also, 48 per cent of the farmers expressed to have voice mail/message instead of text messages. Also, 94.1 per cent of farmers showed inability in operating computer and in turn accessing internet. This is one of the major hurdles to the governments current developmental steps such e-markets

**Table 9: Market information desired by farmers through SMS**

(N=120)		
Type of Information	No. of farmers	Percentage of farmers
Current prices	114	95
Promotional Schemes	73	60.8
Price forecasts	1	0.008
Market arrivals	28	23.3

**Table 10: Problems regarding optimization of market information**

(N=120)		
Problems	No. of farmers facing the problem	Percentage of total
Illiteracy	42	35
English language	105	88
Charges for SMS service	98	82
Voice mail	40	48
Computer literacy	113	94.1

and AGMARKNET.

**CONCLUSIONS**

The study of market news and information services provided by respective market committees revealed that condition of notice boards and ticker boards maintained by respective committees was very poor due to their few numbers, improper location, no regular updating and being out of use. All the market committees did report prices on daily basis on AGMARKNET. Facilities such as Toll free no. , SMS service, library, newspapers, loudspeakers were also not provided by any of the market committees. In Sirsa market, library was found to be in good condition. ABIC was present in every market except Kaithal but the only satisfactorily functioning ABIC was found in Sirsa market with proper library, newspaper, magazines and farming related text in ample amount. The utilization percentage of these facilities showed the real picture as only 17.5 per cent found notice boards useful, 6.6 found ticker boards, 2.5 considered ABIC, 4.1 trusted newspapers and only 0.8 per cent found AGMARKNET useful. These demoralizing results show that not much effort has been done by market committees to address this important aspect of modern day marketing. The NICNET based AGMARKNET being a progressive step has to reach among farmers to succeed in true terms but as per present results the major flaw limitation that has been limiting its success is informative extension work among farmers. Most of the respondents were unaware of the presence of Agri-business information officer in the market yard and his usefulness. The data collected on information desired indicated that most of the farmers wanted timely and adequate information prices and few also added that notifications of various schemes of government and market committees should be provided to them through SMS. The information regarding price forecasts found no place among 119 farmer's wish lists. This shows a lack of competitive edge and short sightedness among farmers. In the investigation, it was also found that 42 per cent of the farmers were illiterate and 88 per cent of them wanted information to be in Hindi. The dependence of farmers was still on unorganized sources of information as they ranked commission agent, fellow farmer and village traders as 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> priority source for getting information on prices. The major cause behind the poor condition of market intelligence services can be attributed to two things, one, lack of importance that should be given by market committees to provide information to farmers via more investment in modern infrastructure. Second and most important is to make farmers realize the importance of such facilities by extension programmes directed at increasing the awareness. Hence the study also made some suggestions such as introductory courses of computer for farmers, increasing the number of functional notice boards, ticker boards, bringing existing infrastructure such as libraries under use and providing them wherever unavailable. Modern facilities such as market news and intelligence

dedicated SMS service providing price forecasts, production forecasts, arrival patterns etc.

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## Cooperative Banks in Haryana-Trends and Challenges in Pathways of Doubling the Farmers' Income: An Empirical Analysis

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### ABSTRACT

The present work is an attempt to study the role of Cooperative banks in accomplishing the aim of doubling the income of farmers by 2022. It is concerned with Haryana, a leading state contributing near about 3.63 per cent of India's GSDP. Primary and secondary data have been used. Primary data have been collected from a well representative sample of 200 farmers from Hisar district of Haryana. It reveals that except some years, Cooperative banks have a good trend in all respects in state. It visualizes that Farmers are confronted with various problems while taking and repaying loan from these banks.

### Keywords

Cooperative banks, credit, financial position, repaying loan, taking loan

### JEL codes

G28, G32, G33, G38

### INTRODUCTION

India, undoubtedly rural India as census 2011 shows that 68.84 per cent of total population of the country lives in rural area. Beside it, more than half of rural population belongs to agriculturist community. Therefore, performance of national economy heavily depends on rural development.

Prime Minister Sh. Narendra Modi has desire to double the income of farmers by the year 2022, which he expressed while addressing a farmers' rally in Bareilly, U.P. on February 28, 2016. Next day, the Finance Minister repeated it in his budget speech. He said that, "We need to think beyond food security and give back to our farmers a sense of income security".

Given the time horizon of six years, doubling of farmers' income must be attempted by creating a framework where all related agencies come together and work in harmony with a maestro conducting that orchestra.

To achieve it, there is need of diversification of crops, enhance irrigation facilities, outreaching of information technology, amendment in land laws, funding by banks,

infrastructure creation in connectivity, marketing, storage, communication etc.

Even after 67 years of independence, Indian agriculture is a gamble of monsoon. So, doubling Farmers' income needs funds at institutional level for which a robust institutional credit flow mechanism is must. We have to create a healthy and smooth credit environment by enhancing access to credit through technology in an equitable manner. Benson (2000) emphasized that borrowers had improved their income after availing credit facilities. Among Institutional credit agencies, Commercial banks, Regional Rural banks and Cooperative banks are the main purveyors of credit in rural areas as Yadav (1999) stated that despite the presence of several financial institutions, the farmers have positive option to become the members of cooperative credit societies. Since their inception, they are playing pivotal role in fulfilling the needs of credit of rural masses. Although their share has been declined yet are playing very prominent role in quenching the credit thirst of farmers

Haryana is one of the leading state that contribute

nearly 3.63 per cent to India's GSDP. During 2014-15, the state's GSDP grew at a compound annual growth rate of 12.12 per cent. In Haryana, more than half of population reside in rural areas and mostly dependent on agriculture. There is a vast network of Cooperative banks in Haryana that is, The Haryana State Co-operative Apex Bank (HARCO) at the state level. There is 19 District Central Co-operative Banks (DCCBs) at district headquarters with their 616 branches and 37761 members and 640 primary agricultural cooperative societies (PACS) with 30.15 lakhs members. These institutions are playing vital role in providing credit facilities to the farmers as Sheoran *et al.* (2011) observed in a case study of PCARDB of Hisar District of Haryana that Cooperative credit institutions among the institutional sources are the most important sources of agricultural credit. Beside it, there are many problems confronted by the borrowers while acquiring loan as Yadav & Pandey (1975) revealed that there is a wide gap between the total credit requirements and its availability. Ineffectiveness and poor services of cooperative have been found as reasons for changing profile of credit cooperatives in rural Haryana (Jodhka, 1995). Muthayya & Prasad (1984) reported that the main problems in getting loan were in terms of procedural aspects like delay, need to visit banks more often and complicated procedures.

The present paper aims to analyze the role of District Central Cooperative Banks in achieving the target of doubling the farmers' income in Haryana. It also visualizes the problems confronted by the borrowers while taking loan from these banks.

#### MATERIALS AND METHODS

The study was conducted in Hisar district of Haryana state. Both primary as well as secondary data has been used for attaining the objective of the study. Secondary data have been taken from various published and unpublished sources on Cooperative banks viz. NAFSCOB, Nabarad etc. Primary data have been collected from Multistage sampling technique has been used with a view to get a well representative sample of the area. From five blocks, two blocks i.e. Model Town block (consisting of villages with more irrigated area) and Hisar block (consisting of villages with less irrigated area) have been selected at the initial stage of sampling. From each selected block, five villages were selected where farmers have taken more loans from co-operative banks. At the final stage of sampling, twenty respondents were selected from each selected village from the list of farmers who have taken loans from the cooperative banks. Thus, in all a sample of 200 farmers was taken for the study. For the analysis of the data statistical tools like ratios, per centages, averages were used to draw the inference of the study.

#### RESULTS AND DISCUSSION

##### Socio-economic Characteristics of the sampled Farmers

It is evident from Table 1 that half of the sampled

farmers were the age group of 31-50 years. About 43 per cent were belonged to small farmers' category. It has been found out that more than half of the sampled farmers were illiterate, twenty eight per cent were educated up to secondary level and only twenty nine respondents were educated up to graduation level i. e. 14.5 per cent. Out of 200 sampled farmers, 114 (57 per cent) had nuclear family. Majority of the sampled farmers were belonging to the SC category (40 per cent). More than half of the sampled farmers having pucca houses followed by mixed and kacha that is, 40 and 9 per cent respectively.

**Table 1: Socio-economic characteristics of the sampled farmers in Hisar district of Haryana**

Particulars	Frequency	Percentage
<b>Age (Years)</b>		
Young (Upto 30)	16	16
Middle (Between 31 to 50)	105	105
Old (Above 50)	79	79
<b>Category</b>		
Large farmers	39	19.5
Medium farmers	74	37
Small farmers	87	43.5
<b>Education</b>		
Illiterate	115	57.5
Up to secondary	56	28.0
Graduation	29	14.5
<b>Family type</b>		
Nuclear	114	57.00
Joint	86	43.00
<b>House</b>		
Kacha	18	9.00
Pucca	102	51.00
Mix	80	40.00
<b>Social class</b>		
General	60	30.00
SC	80	40.00
BC	57	28.5
OBC	03	1.5

##### Financial Status of District Central Cooperative Banks in Haryana

The financial status of the district central cooperatives banks in Haryana are presented in Table 2. It has been found out that share capital has raising trend except some years as it has been declined from ₹37255 lakhs (2012-13) to ₹24234 lakhs (2013-14). Their reserve capital has risen except in year 2008-09 when it declined to ₹38854 lacs from ₹40547 lacs in year 2007-08. Deposits with these banks have been raised from ₹201398 lakhs in year 2002-03 to ₹593859 lakhs in year 2013-14. Beside it, borrowings also have been raised from ₹187329 lakhs in year 2003-04 to ₹556942 lakhs in year 2013-14. The DCCBs have been proved a good source of credit for the borrowers in year 2003-04, loan and advances were

**Table 2: Financial status of district central cooperative banks in Haryana**

(₹ lakhs)						
Year	Share capital	Reserves	Deposits	Borrowings	Working capital	Loan and advances
2002-03	16469	17634	201398	184687	444327	373976
2003-04	17953	23483	229194	187329	488930	41579
2004-05	19236	26319	238200	200969	513716	491050
2005-06	22509	30697	278630	220501	590842	534382
2006-07	24426	33268	293650	257549	643254	541062
2007-08	42501	40547	330438	300095	733738	615232
2008-09	25361	38854	377860	272545	809371	455757
2009-10	27097	42728	435319	269690	840094	511586
2010-11	29541	46634	493488	336725	925669	669989
2011-12	32372	47828	533122	401152	1019098	802857
2012-13	37255	54010	549271	692841	1110548	930106
2013-14	24234	74620	593859	556942	1339323	106813

Source: NAFSCOB

₹415749 lakhs and it has been raised up to ₹106813 lakhs in year 2013-14.

**Problems faced by Farmers in Acquisition and Repayment of Loan**

Various problems have been sorted out from the contacted farmers of different categories in acquisition and repayment of loan. The perusal of Table 3 reveals out that various problems complained by the sampled farmers while acquisition and repayment of loan. 56 per cent complained about complicated procedure of loan seeking. 16 per cent of the sampled farmers said that officials of the banks are not cooperative. Near about 27 per cent of the contacted farmers opined that their illiteracy is a big hurdle as they do not know about the procedures of loan seeking. 38 per cent found out that they did not get sufficient amount of credit.

**Table 3: Problems faced by farmers in acquisition and repayment of loan**

Reasons	Frequency	Percentage
Complicated procedure of loan seeking	112	56.00
Officials not cooperative	32	16.00
High rate of interest	76	38.00
Insufficient amount	76	38.00
Amount not available timely	33	16.50
Illiteracy of borrowers	53	26.60
Expenses on loan seeking process	79	39.50

**Suggestions by the Respondents to Improve Banking Facilities**

During interaction with the respondents, they put some suggestions to improve the banking facilities which have been depicted in Table 4. It has been found out that near about 44 per cent of the respondents suggested for

**Table 4: Suggestions by farmers improve banking facilities**

Suggestions	Frequency	Percentage
More Amount	89	44.50
Less rate of interest	53	26.50
Timely availability of loan	81	40.50
Simple loan Procedure	77	38.50
Information to people about policies of Government	89	44.50
Govt. should write off loan in case of crop failure	79	39.50

more amounts should be disbursed. Other suggestions revealed out as less rate of interest ( near about 27 per cent), timely availability of loan (40 per cent), Simplified loan procedure (near about 39 per cent), Dissemination of information about government policies to the general people (near about 44 per cent), etc.

**CONCLUSIONS AND RECOMMENDATIONS**

This study was conducted to examine the role of Cooperative banks in Haryana to accomplish the target of doubling the farmers' income by 2022. The results of the study indicated that except some years, District Central cooperative Banks have shown a good trend in all respects. It means they are playing a prominent role providing credit facilities to the farmers. On the other hand, it was found out that there were many hurdles in the pathways to achieve target of doubling the farmers' income because contacted farmers put their problems confronted while taking and repaying loan. Some problems cited by them were as complicated procedure of loan seeking, Officials not cooperative, high rate of interest, insufficient amount, amount not available timely, illiteracy of borrowers, expenses on loan seeking process etc.

So, some sturdy steps should be taken to overcome these problems so that outreaching of these institutions can be enhanced and they can prove more helpful to fill the demand of credit of farmers. Only then, farmers can take important steps to make their profession more efficient.

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## **A Study on Warehousing Space Analysis for increasing Rural Income in Vidisha and Ganjbasoda Districts of Madhya Pradesh**

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### **ABSTRACT**

*Warehouse is constructed for the protection of the quality and quantity of the stored produce. Need arises due to time gap between production and consumption of products. Warehousing in India is linked to food security and agricultural growth. Purpose of study is to access warehouse market potential of NCML, analyze storage gap during storage and to map the all potential clients for NCML. Total sample size was 139 in Vidisha & Ganjbasoda (50Warehouses, 17 Banks, 72 Mandi traders). Warehousing plays vital role in promoting rural banking and financing. The Government of India has introduced a NWR system in the country.*

### **Keywords**

Food security, rural, storage gap, traders, warehouse

### **JEL Codes**

C10, C81, C83, C88, C93, G12, G23, H57, H81, L89

### **INTRODUCTION**

Warehouse is a storage structure constructed for the protection of the quality and quantity of the stored produce. The need for a warehouse arises due to the time gap between production and consumption of products. Warehousing or storage refers to the holding and preservation of goods until they are dispatched to the consumers. By bridging this gap, storage creates time utility. The National Collateral Management Services Limited (NCML) is the country's leading organization providing a bouquet of commodity based services under a single umbrella.

Warehouses of the future will become more like true distribution centers where supplies that come in, immediately go out without storage of the products. With less storage, more cross-docking operations will occur. Cross-docking is a practice in the logistics field of unloading materials from an incoming truck and loading these materials directly into outbound trucks, trailers, or rail cars, with little or no storage in between. Inventory management is reported as the most challenging source of inefficiencies, as well as an area where it would be easiest to gain cost savings through technology. Utilizing systems such as RFID-tags that identify, diagnose, and

prevent out-of-stock conditions, will help to remove uncertainty from in-store inventories and prevent lost sales.

Choudhary (2008) reported that warehouse receipt based finance is one of the oldest lending products; it really could never take off in India due to several infirmities and resultant perception of high risk. The reasons of high risk the bank perceives are very low credibility of warehouse management, lack of quality and commodity value appraising skills. According to Coulter & Martines (1998) warehouse receipt finance can play an important role in smoothening income for farmers by providing liquidity at times when cash flows dry out. In this context Kiriakov (2007) viewed that government institutions and market participants should form a consensus on the necessities of the WRS and commit to be involved in the process. Without the political will and understanding of the benefits that the system brings to participants there is a high probability for failure. Based on the views of Barnwal (2006) developing more warehousing infrastructure is the need of hour, as the population is growing and there is always dearth of food grains and other agri. commodities. As Indian agriculture is dependent on monsoons, there are always cry to arrange

the enough food grain for the masses. Warehousing infrastructure will be able to store more unseasonable foods and other items. Nukenine (2010) try to correlate the unscientific space and location analysis with grain losses. According to the author rate of insect proliferation in tropical Africa's grain storage structures in high because of the warm climate. Annual grain losses of up to 50 per cent in cereals and 100 per cent in pulses have been reported, although average losses stand at roughly 20 per cent.

So this research was undertaken with following objectives in mind:

- i. to assess Warehouse Market Potential of NCML Project locations and conduct storage gap analysis,
- ii. to understand WHR based funding potential, acceptability, financing available at each level, data base of local financiers/ Money lenders and their terms and conditions, current banks into funding and farmer funding potential, and
- iii. to understand movement pattern of major commodities

#### MATERIALS AND METHOD

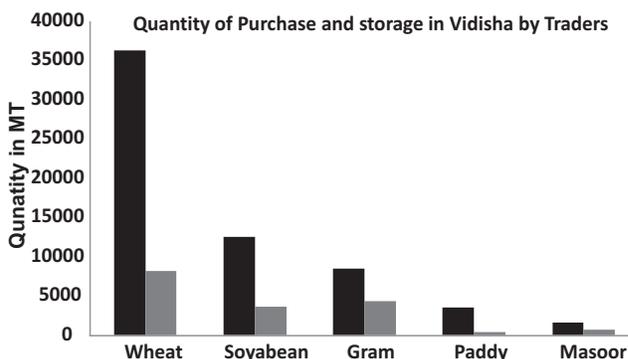
To understand WHR based funding potential, acceptability, financing available at each level, data base of local financiers/ Money lenders & their terms and conditions, current banks into funding and farmer funding potential, movement pattern of major commodities and assess warehouse market potential of NCML in study area. The area covered was part of Madhya Pradesh which is comes under Vidisha and Ganjbasoda Tehsils. Entire area has very good agriculture potential. These areas have same type of cropping pattern and major sowing area comes under Wheat, Soya bean, Gram and Teora. For the project in total 2 Tehsils were selected in the state of Madhya Pradesh. Both Tehsils comes under Vidisha headquarter of company which includes different division of Madhya Pradesh, namely Bhopal division. Total sample size was 77 in Vidisha (25 Warehouses, 10 Banks, 42 *Mandi* traders and 62 in Ganjbasoda (25 Warehouses, 7 Banks, 30 *Mandi* traders).for this study convenient and judgemental sampling were followed. Survey was done through structured questionnaire.

#### RESULTS AND DISCUSSION

Total warehousing of Vidisha is 169892 metric tonnes (MT) which is 47.92 per cent of total *Mandi* arrivals and Current commodity stored in these warehouses is 122851MT 72 per cent of total storage capacity. NCML storage capacity is 13117MT which is 8 per cent of total storage capacity and 11540MT current commodity stored which is 9 per cent of total consumption. The total warehousing capacity of Ganjbasoda is 184484MT which is 64.91 per cent of total *Mandi* arrival and current commodity stored in these warehouses is 108094MT which is 58.59 per cent of total consumption. NCML storage capacity is 20700MT which is 11.17 per cent of

total warehousing capacity and consumption is 200MT which is 0.18 per cent of total consumption. The total number of value chain participants I have covered in Vidisha is 42 and all are traders. Major commodities that traders purchase are Wheat, Soyabean, Gram, Paddy, and Masoor.

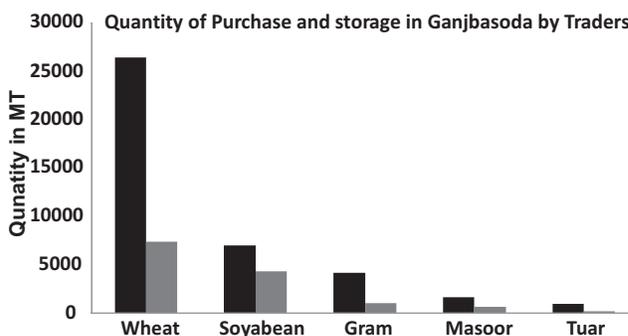
Figure 1: Quantity of purchase and storage in Vidisha by traders



Source: Primary data

In 42 value chain participant's major commodities they purchase are wheat (36350MT), soybean (12527MT), gram (8464MT), paddy (3500MT), and masoor (1650MT) and they stored 8252, 3650, 4350, 400, and 750MT quantities respectively.

Figure 2: Quantity of purchase and storage in Ganjbasoda by traders



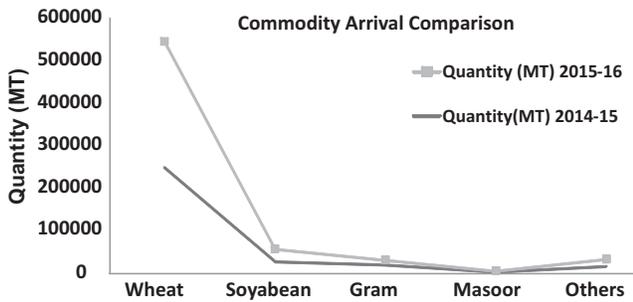
Source: Primary data

In 30 value chain participant's major commodities they purchase are wheat (26400MT), soybean (7040MT), Gram (4200MT), Tuar (1000MT), and Masoor (1650MT) and they stored 7400, 4365, 1080, 200, and 725MT quantities respectively.

In 2014-15 Annual *Mandi* arrival of Vidisha was 316260MT which is increased 12per cent in 2015-16 and become 354544MT. annual arrival of Wheat and soybean increase respectively 20 and 3.24 per cent and arrival of Gram decreased with 44 per cent.

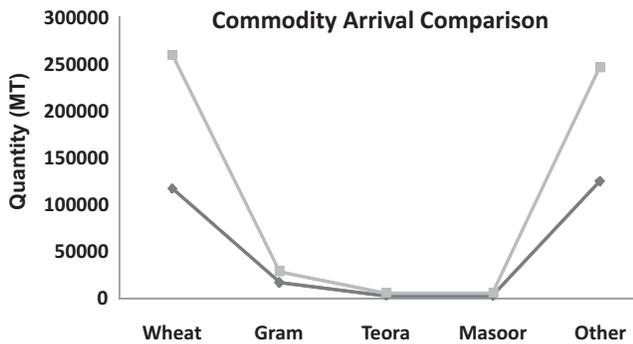
In 2014-15 Annual *Mandi* Arrival of Ganjbasoda is 263210MT which is increased with 8per cent in 2015-16 and become 284219MT. Major commodities in

Figure 3: Mandi arrival comparison in Vidisha



Source: Primary data

Figure 4: Commodity arrival comparison in Ganjbasoda



Source: Primary data

Ganjbasoda are wheat, Gram, Teora and Masoor. Wheat, Soybeans and Masoor Mandi arrival increased 22, 12.75, and 51.12 per cent respectively and arrival of gram decrease with 24.23 per cent compare to previous year.

WHR based funding in Vidisha is total consumption of commodities is 122851MT in which 52660 MT commodities are under funding which is 43 per cent of total consumption and there is 70191 MT quantities is under non funding which is 57 per cent of total Consumption and funding in Ganjbasoda is total consumption of commodities is 108094 MT in which 48440 MT commodities are under funding which is 45 per cent of total consumption and there is 59654 MT quantity is under non funding which is 55 per cent of total Consumption.

In Vidisha total 10 respondents 8 Banks pledged funding and their interest rate on WHR are SBI (11.30 per cent), UBI (9.65 per cent), HDFC (11 per cent), IDBI (9.60 per cent), Corporation Bank (9.65 per cent), DENA Bank (9.60 per cent), ICICI (11.50 per cent), and UCO Bank (9.60 per cent), while Interest Rate on WHR in Ganjbasoda In total 7 respondents 5 Banks pledged funding and their on WHR are SBI (10.25 per cent), RBL (11.50 per cent), UCO (10.65 per cent), UBI (9.65 per cent), and HDFC Bank (11 per cent).

Storage Division oversees policy related aspects aimed at ensuring sufficient storage capacity for Central Food Stocks. It also endeavors to facilitate logistic

support to the Indian economy, especially for agricultural and notified commodities, through two CPSEs namely CWC and CRWC under its administrative control. It is also the administrative division for one Regulatory Authority (WDRA).

## CONCLUSIONS

### Vidisha

- Annual Mandi arrival in Vidisha is 354544 MT and total Warehousing capacity is 169892 MT which 47.92 per cent of total Mandi arrival
- Major arrival of commodities in Vidisha is Wheat, Soyabean, and Gram which have 296383.7 MT, 28737.1 MT and 11190 MT quantities respectively.
- Current commodity stored (Consumption) in Vidisha is 122851 MT which is 72 per cent of total warehousing capacity
- NCML warehouse capacity in Vidisha is 13117 MT which is 8 per cent of total warehousing capacity.
- Consumption in NCML warehouse is 11540 MT which is 9 per cent of total consumption
- In Vidisha 8-10 Banks are pledged WHR based funding
- Maximum value chain participants are aware about storage and WHR based funding which will be helpful for NCML to increase market potential.

### Ganjbasoda

- Annual Mandi arrival in Ganjbasoda is 284204 MT and total warehousing capacity is 184485 MT which is 64.91 per cent of total Mandi arrival.
- Major arrival of commodities in Ganjbasoda is Wheat, Gram, and Masoor which have 142870, 12569, and 3644 MT quantities respectively.
- Current commodity stored (Consumption) in Ganjbasoda is 108094 MT which is 58.59 per cent of total warehousing capacity.
- NCML warehousing capacity in Ganjbasoda is 20700 MT which 11.22 per cent of total warehousing capacity.
- Consumption in NCML warehouse is 200 MT which 0.18 per cent of total consumption.
- In Ganjbasoda 4-6 Banks are pledged WHR based funding.

## SUGGESTIONS

- Location is major issue to establish a warehouse, NCML warehouse is 6km far away from Mandi so farmers and value chain participants prefer nearby warehouses.
- NCML have increasing WHR based funding year by year but their competitors too increasing market share.
- NCML have a good image in front of Value chain

participants, Banks so they can increase it from regular visit.

- Focus on price adjustment according to competitors and timely availability
- Company name, quality and effectiveness are three most preferred factors those considered by Value chain participants, so company should pay more focus on these factors.

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## Strengthening SPS Management Capacity in India to Enhance Competitiveness and Better Realisation by Farmers<sup>#</sup>

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### ABSTRACT

The vast production base offers India tremendous opportunities for export. India is among the 15 leading exporters of agricultural products in the world. The increased globalization and liberalization of international markets, facilitated by both bilateral trade agreements and the WTO, are opening new export markets for Indian agricultural products, both fresh and processed. But the share of agricultural exports in total exports decreased from 11.20 per cent in 2004-05 to 10.47 per cent in 2010-11. SPS issues are affecting India's export adversely. Despite being one of the major horticultural producers in the world, India is the small player in the global horticultural export trade, a major challenge is now meeting sanitary and phytosanitary (SPS) standards. FFV is one of the categories of food items most frequently affected by sanitary and phytosanitary (SPS) measures. Maximum Residue Limit (MRLs) of pesticide is the main SPS issue in case of fruits and vegetables. Strengthening SPS management capacity in India can contribute to growth, better realisation and poverty reduction by increasing the competitiveness of Indian exports, improving domestic food safety and promoting adoption of safer and more sustainable agricultural practices. .

### Keywords

Export competitiveness, maximum residue limits, sanitary and phytosanitary standards

### JEL Codes

F13, F14, O13, O24, Q17, Q18

### INTRODUCTION

Agriculture is the important sector of the Indian economy. Although the share of the agriculture and allied sector in the country's GDP is declining, a trend that is expected in the development process of any economy, agriculture yet forms the backbone of development. Its role in the country's economy is much bigger with its high share in total employment.

India is among the 15 leading exporters of agricultural products in the world (Economic Survey 2011-12). As per international trade statistics, 2010, published by WTO, India's agricultural exports amounted to US \$ 17 billion with a share of 1.4 per cent of world trade in agriculture in 2009. Agricultural exports increased from ₹39863.31 crore in 2004-05 to ₹120185.95 crore in financial year

2010-11. However the share of agricultural exports in total exports decreased from 11.20 per cent in 2004-05 to 10.47 per cent in 2010-11. In terms of value, cotton, oil meals, rice basmati, sugar, castor oil, guar gum meal, cashew, fresh vegetables, sesame seed are the top 10 agricultural export items from India during 2010-11.

Horticulture has emerged as a core sector in agriculture passing through various phases with coverage of nearly 22.25 million hectare. There has been a phenomenal increase in area, production and productivity during 2001 to 2011 amounting to 34 per cent, 70 per cent and 26 per cent, respectively. With the growth trend, horticulture is expected to play a dominant role in the overall development of agriculture in the country in the coming years. The cultivation of horticultural crops,

<sup>#</sup> This article is drawn from Master's Thesis entitled *A study on impact of sanitary and phytosanitary measures on export of major fruits and vegetables from India* submitted by first author to BHU, Varanasi

especially fruits and vegetables, plays a vital role in the prosperity of the nation and is directly linked with the health and happiness of its people. Fruits and vegetables, together, constitute about 92 per cent of the total horticultural production in the country. India is the second largest producer of vegetable after china having a share of 14 per cent in world vegetable production. India is also the second largest producer of fruits in the world having a share of 12.5 per cent of total world fruit production.

The vast production base offers India tremendous opportunities for export. During 2011–12, India exported fruits and vegetables worth ₹4801.29 crores which comprised of fruits worth ₹1779.49 crores and vegetables worth ₹3021.74 crores (APEDA, 2013). The emphasis on horticulture is recognition of the need for attaining nutritional security and also for a sustainable income. The increased globalization and liberalization of international markets, facilitated by both bilateral trade agreements and the WTO, are opening new export markets for Indian agricultural products, both fresh and processed. In response to these new opportunities, India's agriculture exports are also diversifying from traditional export of tea, spices, and coffee to horticulture, fisheries, and livestock products. During the period 1990–91 to 2003–04, the highest growth in real terms were recorded by fruits and vegetable exports and cashew and spices followed by marine exports.

Despite being one of the major horticultural producers in the world, India is the small player in the global horticultural export trade. As Indian agricultural exports have shifted in destination to high income countries and in composition to non-traditional exports like fruits and vegetables and marine products, a major challenge is now meeting sanitary and phytosanitary (SPS) standards.

As per the SPS agreement of the WTO, each country is allowed to set their own standards and technical regulations as long as they are based on scientific principles, and are both transparent and non-discriminatory. WTO members are encouraged although not required to adopt the internationally recognized standards, guidelines and proposals of the Codex Alimentarius (for food safety), the International Plant Protection Convention (for plant health), and the Organization for International Epizootics (for animal health).

India faces a number of SPS challenges related to its horticultural exports. SPS issues are affecting India's export adversely (Patel & Dube, 2006; Singh, 2009; Neeliah et al., 2011). Strengthening SPS management capacity in India can contribute to growth and poverty reduction by increasing the competitiveness of Indian exports, improving domestic food safety and promoting adoption of safer and more sustainable agricultural practices (Dangat et al., 1997). An attempt has been made to analyse the SPS issues in major fruits and vegetables of India.

To identify various SPS issues responsible for export

rejection, a detailed review of literature was done. SPS specifications regarding MRLs in fruits and vegetables of different countries were tabulated and compared with codex standards. Case studies of export rejection in the past were studied and cited as example of SPS issues responsible for export rejection.

#### Issues related to sanitary and phytosanitary measures

Growing concern on food safety issues has resulted into increased rate of notifications of SPS measures to WTO. FFV is one of the categories of food items most frequently affected by sanitary and phytosanitary (SPS) measures. Amongst fruits and vegetables, higher number of notifications has been notified in case of Fruits as compared to vegetables. Maximum Residue Limit (MRLs) of pesticide is the main SPS issue in case of fruits and vegetables. So, Maximum Residue Limit (MRLs) of different pesticide adopted by different countries were reviewed which are presented in the following sub-sections of this section.

The perusal of Table 1 shows the maximum residue limit (MRL) of different insecticide used in fruits and

**Table 1: MRLs of different insecticide in fruits and vegetables**

Name of insecticide	Maximum residue limit (MRLs)	
	Fruits	Vegetables
Aldrin, dieldrin	0.1	0.1
Chlordane	0.1	0.2
D.D.T.	3.5	3.5
Diazinon	–	0.5
Dichlorovos	0.1	0.15
Dicofol	5.0	5.0
Dimethoate	2.0	2.0
Endosulfan	2.0	2.0
Fenitrothion	0.5	0.3
Heptachlor	–	0.05
Hexachlorocycle hexane & its isomers	1.0	1.0
Malathion	4.0	3.0
Parathion	0.5	0.5
Parathion Methyl	0.2	1.0
Phosphamidon residues	0.2	0.2
Pyrethrins	1.0	1.0
Chloreinvinphos	–	0.05
Chlorobenzilate	1.0	–
Chlorpyrifos	0.5	0.2
Formethion	1.0	2.0
Paraquat dichloride	0.05	0.05
Trichlorfon	0.1	0.1
Captan	15.0	15.0
Carbofuran	0.10	0.10
Copperoxychloride	20	20

Source: APEDA

vegetables. It indicates that some insecticide like aldrin, dieldrin, dichlorovos, fenetrothion, parathion, Phosphamidon, Chlorpyriphos, Paraquat dichloride etc. are permissible in fruits and vegetables in the range of 0.1–0.5 mg per kg while insecticide like Copperoxychloride, captan, dicofol, etc. are permissible in residual form in the range of 5–15 mg per kg. The residual limit of same insecticide also varies with fruits and vegetables or within fruits or vegetables.

The perusal of Table 2 reveals the SPS standard adopted by international organization CODEX, European Union (EU) and the U.S. in the form of MRLs for the fruit crop banana. There are 19 pesticide listed in table for banana crop out of which only 5 pesticide follows the codex standard in U.S. while EU follows the codex standard of maximum residue limit for almost all pesticides.

It is revealed from the Table 3 that EU and U.S. do not follow the codex standard for almost all of the pesticide listed above for grapes. Almost for half of the pesticide listed above EU has stricter standard than codex while EU has less stringent standard than codex for more than half of pesticide listed in the Table 3.

In the Table 4 twenty pesticides are listed for the onion crop. The table compares the codex, US and EU standard for MRLs of different pesticide. It shows the variation in the limit of residue adopted across the countries.

There are 15 pesticide listed in the Table 5 for the fruit crop of mango. This result also reveals the variation in the standard of codex, US and EU.

**Impact of SPS measures and challenges for export of horticultural crops**

**Table 2: Maximum residue levels (MRLs) for bananas across countries**

Pesticide	Codex	US	EU
Azoxystrobin	2.0*	2.0*	2.0*
Chlorpyriphos	2.0*	0.1 (+)	3.0 (-)
Chlorothalonil	0.01*	0.5 (-)	0.2 (-)
Ethoprophos	0.02*	0.02*	0.02*
Febuconazole	0.05*	0.3 (-)	0.05*
Fenarimol	0.2*	0.25 (-)	0.2*
Glyphosate	0.05*	0.2 (-)	0.1 (-)
Glufosinate ammonium	0.2*	0.3 (-)	0.2*
Imidacloprid	0.05*	0.5 (-)	0.05*
Imizalil	2.0*	3.0 (-)	2.0*
Mancozeb	2.0*	4.0 (-)	2.0*
Myclobutanil	2.0*	4.0 (-)	2.0*
Propiconazole	0.1*	0.2 (-)	0.1*
Pyraclostrobin	0.02*	0.04 (-)	0.02*
Pyrimethanil	0.1*	0.1*	0.1*
Thiamethoxam	0.02*	0.02*	0.05 (-)
Tebuconazole	0.05*	0.05*	0.05*
Terbufos	0.05*	0.025 (+)	0.05*
Thiabendazole	5.0*	3.0 (+)	5.0*

\*Follows codex standard; (+)=Stricter than codex; (-)=Less stringent than codex

**Table 3: Maximum residue levels (MRLs) for grapes across countries**

Pesticide	Codex	US	EU
2,4-D	0.1*	0.1*	0.05(+)
Azinophos methyl	1.0*	4.0(-)	0.05(+)
Bifenazate	0.7*	0.75(-)	0.7*
Boscalid	5.0*	3.5(+)	5.0*
Carbaryl	5.0*	10.0(-)	0.05(+)
Clofentezine	1.0*	1.0*	0.02(+)
Cyprodinil	3.0*	3.0*	5.0(-)
Dicloran	7.0*	10.0(-)	0.1(+)
Ethepon	1.0*	2.0(-)	1.0*
Fenarimol	0.3*	0.1(+)	0.3*
Fenbutatin oxide	5.0*	5.0*	2.0(+)
Fenhexamid	15.0*	4.0(+)	5.0(+)
Inorganic Bromide	20.0*	20.0*	20.0*
Malathion	5.0*	8.0(-)	0.5(+)
Metalaxyl	1.0*	2.0(-)	2.0(-)
Methomyl	0.3*	5.0(-)	0.05(+)
Paraquat dichloride	0.01*	0.05(-)	0.02(-)
Thiophanate Methyl	1.0*	5.0(-)	0.1(+)
Triadimefon	0.5*	1.0(-)	2.0(-)
Trifloxystrobin	3.0*	2.0(+)	5.0(-)

\*Follows codex standard; (+)=Stricter than codex; (-)=Less stringent than codex

The challenges posed by the standards have manifested themselves in different ways (World Bank 2006) for Indian horticulture includes:

- Absolute barriers or binding constraints for fresh mango entry into US, Japan and Australia markets;
- Temporary losses due to rejected and sometimes destroyed consignments of fresh or processed products;
  - Grape consignment rejections in Europe,
  - Border rejections of many small consignment of processed fruits and vegetables,
  - Onion consignment rejections in Europe, and
  - Periodic price discounts by private buyers.
- Higher consignment-specific or recurrent transaction costs due to duplicative testing, high levels of entry point inspection or further treatment of goods upon overseas market arrival;
  - Pesticide monitoring programme for grapes,
  - Fumigation of cut flowers in Japan,
  - Stalled upgrading of mango pulp operations, and

**Table 4: Maximum residue levels (MRLs) for onions across countries**

Pesticide	Codex	US	EU
Abamectin	0.01*	0.01*	0.01*
Acetaprimid	0.02*	4.5 (-)	0.01(+)
Cyromazine	0.1*	3.0 (-)	0.05 (+)
Chlorpyrifos	0.2*	0.1 (+)	0.05 (+)
Chlorothalonil	0.5*	5.0 (-)	10.0 (-)
Clethodim	0.5*	2.0 (-)	0.5*
Cyprodinil	0.3*	4.0 (-)	1.0 (-)
Deltamethrin	0.05*	1.5 (-)	0.1(-)
Diazinon	0.05*	0.75 (-)	0.02 (+)
Fluopicolide	1.0*	7.0 (-)	10.0 (-)
Fludioxonil	0.5*	7.0 (-)	0.3 (+)
Imidacloprid	0.1*	2.5 (-)	0.2 (-)
Methomyl	0.2*	3.0 (-)	0.02 (+)
Malathion	1.0*	8.0 (-)	0.02 (+)
Mandipropamid	0.1*	4.0 (-)	7.0 (-)
Metalaxyl	2.0*	10.0 (-)	0.2 (+)
Pyrimethanil	0.2*	3.0 (-)	0.05 (+)
Spinosad	0.1*	2.0 (-)	4.0 (-)
Tebuconazole	0.1*	1.3 (-)	0.5 (-)
Zeta cypermethrin	0.01*	3.0 (-)	0.05 (-)

\*Follows codex standard; (+)=Stricter than codex;  
(-)=Less stringent than codex

**Table 5: Maximum residue levels (MRLs) for mangoes across countries**

Pesticide	Codex	US	EU
Abamectin	–	0.01	0.01
Acephate	–	0.02	0.02
Azoxystrobin	0.7*	2.0 (-)	0.7*
Buprofezin	0.1*	0.9 (-)	0.1*
Cypermethrin	0.7*	0.7*	0.7*
Deltamethrin	–	0.05	0.05
Imidacloprid	0.2*	1.0 (-)	0.2*
Lambda-Cyhalothrin	0.2*	0.01(+)	0.2*
Malathion	–	8.0	0.02
Mancozeb	2.0*	15.0 (-)	2.0*
Paraquat dichloride	0.01*	0.05 (-)	0.02 (-)
Pyralostrobin	0.05*	0.6 (-)	0.05*
Spirotetramate	0.3*	0.6 (-)	0.3*
Tebuconazole	0.05*	0.15 (-)	0.1(-)
Thiabendazole	5.0*	10.0 (-)	10.0 (-)

\*Follows codex standard; (+)=Stricter than codex;  
(-)=Less stringent than codex

- Good agricultural practices and smallholder vegetable growers.
- Patterns of “defensive commercialisation” whereby firm fail to pursue opportunities for remunerative trade with certain countries because of concerns about their inability to ensure compliance with regulatory or provide

standards in those market.

- Processed fruits and vegetables sales by small and medium enterprises,
- Grape export strategies,
- Onion export strategies,
- Avoidance of certain cut flower markets.
- Looming Threats
  - Heavy metals in fresh and processed vegetables,
  - Pesticides in pomegranate,
  - Requirements of traceability in process fruits and vegetables,
  - Environmental and social requirements in cut flowers.

#### Example of various SPS issues responsible for rejection

In 2008, Bio security Australia (BA) banned imports of apples from countries where firelight was present. SreeNanda exports having its branch in Azadpur Mandi, New Delhi as well as J & K has traditionally been an apple exporter to Australia. Fireblight was present in some cases from apples originating from Himanchal Pradesh in India, the presence of fireblight in regions like J & k with low temperatures was not possible. Hence the import bans, if applied should be region specific instead of banning the country altogether leading to a financial burden to the exporters.

In December 2009, Grape exporter from India faced a loss of an estimated ₹273 crore as European authorities had rejected consignments from India over the use of a chemical chlormequat chloride to preserve the fruit. Grape Exporters from Maharashtra, especially from Nashik, Pune and Sangli, which are major grape growing and exporting districts in the state, suffered the losses.

Lucre International, Mumbai has been exporting oranges to Malaysia and Seychelles until 2009. After attending ANUGA trade fair in October 2009 in Germany, company decided to expand its business into orange juice in European markets as well. However the company was unable to do so due to the strict packaging norms laid by EU.

In the month of Jan 2011, US demanded for proper grading of tomatoes. Desai fruits from Navsari in Gujrat have been exporting tomatoes to USA since 2007 using Kandla port. Company had to go for mechanical grading & had to shift from Surat to Mumbai. Quality of tomatoes degraded due to poor shelf life of tomatoes by the time it was ready to be exported. These additional requirements stated by USA resulted into the added cost of domestic transportation and the delay leading to quality issues due to poor shelf life of tomatoes. The consignment which was expected to clear the customs during February 2011 could enter only in mar 2011 by which time the prices in the US market fell down from 446.52 US\$ per tonne to 421.41 US\$ per tonne. Therefore apart from bearing the

cost of lab services, cold storage and USDA inspection charges, the company also had to forgo better price realization and had to incur the loss.

### **CONCLUSIONS**

Keeping in view the opportunity in global market, good agronomic practices and high yield plant varieties are recommended for meeting growing domestic demand and to be the global leader in the export of fruits and vegetables. Appropriate steps should be initiated to increase India's share in the importing countries by offering quality fruits and vegetables at competitive prices than producing countries. Since different countries are adopting different standards therefore, it is suggested that an awareness capacity building program should be initiated among farmers cultivating these crops with high marketable surplus and wish to export in global market. In depth analysis of the new destination should be conducted to know the consumer perception, various SPS measures. So that the producer and exporter may be made aware in order to get the maximum benefit of the global market.

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## Market-Led-Extension: Scope and Challenges in the Present Scenario

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### ABSTRACT

Market-Led-Extension approach is an effective mechanism to transform of the traditional production driven approach to market driven approach, to reduce production costs and converting the agriculture into a profitable venture. The extension personnel are required to possess information regarding land demand of crop, credit facilities, transport facilities and market intelligence. Use of IT in agriculture is utmost important link the buyers and sellers to provide the information regarding the stock, purchasing and selling of commodities. Several opportunities in the Market-Led-Extension involve tapping the new trends in marketing, establishing the supply chain Management, contract farming and direct marketing of the produce.

### Keywords

Market-Led-Extension, opportunities, problems, SWOT

### JEL Codes

L11, L15, L26, M31, N7, O13, Q16

### INTRODUCTION

In India, agricultural production has increased significantly in last decade, claiming record of food grain production. Still farmers are unable to gain in different walks of life. It is due to high cost of production and low returns from their enterprises. Extension approach in India has been largely production driven. So, it is necessary to transform the traditional production driven approach to market driven approach with the globalization of market. Extension can play its pivotal role not by mere transfer of technology to farm side but also by disseminating the appropriate market information to the farmers. Effective linkages of production systems with marketing, agro-processing and other value added activities would play an important role in the diversification of agriculture.

The word market comes from the Latin word "marcatu", which means merchandise or trade or a place where business is conducted. Market means a social institution which performs activities and provides facilities for exchanging commodities between buyers and sellers (Wader & Murthy, 2003). Marketing is an important part of any successful business. It connects what the customer wants with what the producer can produce and supply at a profit. Marketing contains a series

of activities involved in moving the goods from the point of production to the point of consumption. It includes all the activities involved in the creation of time, place, and form (Wader and Murthy, 2003). The word "extension" is derived from the Latin roots *Ex* meaning *Out* and *Tension* meaning *stretching*. Extension is that type of education which is stretched out to people in the rural areas far and near, beyond the limits of the educational institution to which the formal type of education is usually confined. Extension is to bring about desirable changes in the behaviour-knowledge, skills, attitude, understanding, goals and confidence of the people through mutual learning. Extension means to extend, to spread or to disseminate useful information and ideas to rural people outside the regularly organized school and class rooms (Sharma & Somani, 2012). Market led Extension is the market ward orientation of agriculture through extension includes agriculture & economics is the perfect blend for reaching at the door steps of farming community with the help of appropriate technology (Kaleel, 2007). Market-led means to identify customer needs and wants before offering a service.

### Need of Market-led extension

- Farmers are not able to sell their produce fairly.
- Plenty of distress sales among farmers

**Table 1: Differentiation from the production-led extension**

Aspects	Production-led extension	Market-led extension
Purpose/objective	Transfer of production Technologies	Enabling farmers to get optimum returns out of the enterprise
Expected end results	Delivery of messages adoption of package of practices by most of the farmers	High returns
Farmers are seen as	Progressive farmer, high producer	Farmer as an entrepreneur “Agripreneur”
Focus	Production / yields “Seed to seed”	Whole process as an enterprise / high returns “Rupee to Rupee”
Technology	Fixed package recommended for an agro-climatic zone covering very vast area irrespective of different farming situations	Diverse baskets of package of practices suitable to local situations/ farming systems
Linkages	Research-Extension-Farmer	Research-Extension-Farmer extended by market linkages
Maintenance of Records	Not much importance was given as the focus was on Production	Very important as agriculture viewed as an enterprise to understand the cost benefit ratio and the profits generated
Information Technology Support	Emphasis on production Technologies	Market intelligence including likely price trends, demand position, current prices, market practices, communication network, etc. besides production technologies

Source: Anonymous, 2013

- Minimization of production cost.
- Expansion of Market - more of agribusiness and trade.
- Introduction of export oriented products.
- Modernization of wholesale markets with new Agricultural policy.
- Globalization/ Economic liberalization.
- Revolution in Information Communication Technology (ICT).
- New trade opportunities within and outside the country.
- Conversion of Agriculture sector into profit oriented business
- Strengthening market linkages to farmers-IT application in Agricultural marketing (Anonymous, 2008)

**Institutions for Market led extension In India**

- State Agricultural Universities
- National Institute of Agricultural Extension Management (An organisation of ministry of agriculture, GOI) Hyderabad
- National Institute of Agricultural Marketing
- State Institute of Agriculture Management
- State Agricultural Management and Extension Training Institute, SAMETI (State level training institute)
- ICAR (Indian Council of Agriculture Research)
- NARSS (National Agriculture Research

Systems)

- KVK (Krishi Vigyan Kendra)
- NHB (National Horticulture Board)
- SAMB (State Agriculture Marketing Boards)
- APEDA (Agri. & Processed food product Export Development Authority) (Anonymous, 2011)

**Information Required to Extension Personnel and Farmers in Market Led Extension**

Extension system and farmers both should have knowledge on the following aspects:

- Present agricultural scenario and land use pattern
- Suitability of land holding to various crops/enterprises
- Crops in demand in near future
- Market prices of crops
- Availability of inputs
- Usage of inputs
- Credit facilities- Helps farmers to arrange quality of input required for production
- Direct marketing- Direct marketing by farmers is being encouraged as an innovative channel
- Desired qualities of the products desired by consumers- needed for competitive marketing
- Market network of the local area and the price differences in various markets
- Network of storage and warehouse facilities available
- Transport facilities- Especially for perishable produce like milk, vegetables.

- Production technologies like improved varieties, organic farming, usage of bio-fertilizers and bio-pesticides, and right methods of harvesting etc.
- Post-harvest management like processing, grading, standardization of produce, value addition, packaging, storage, certification, etc. with reference to food grains, fruits and vegetables, eggs, poultry, fish, etc.
- Regular updating of market intelligence
- Contract farming-Contract farming that helps infusion of new technology and capital in farm business should be popularized and encouraged.
- Food safety and quality standard-Should promote consumer demand for safe and healthy foods, so that the demand will drive the implementation of food safety measures, which will ultimately enable us to capture global markets. Price incentives can provide demand-pull for quality and safe food(Anonymous 2013).

**Role of Agricultural Extension Personnel in Market-led Extension**

Extension personnel are assigned the responsibility of conveying research findings from the scientists to the farmers and feeding back the impressions from the farmers to the scientists. The new dimensions of marketing may overburden them and become an agenda beyond their comprehension and capability. In the light of this scenario, the extension personnel are required to be motivated to learn the new knowledge and skills of marketing before assigning them marketing extension jobs to establish their credibility and facilitate significant profit for the farming community. Emphasis should be given on climate-based extension education by devising training programmes, demonstrations etc. to the farmers empowering them to adopt improved technologies for higher yields and other high-tech ventures. For this purpose the farmers need to know the answers to questions, like what to produce, when to produce, how much to produce, when and where to sell at what price and in what form to sell their produce. In responding to such questions the extension system should be oriented with knowledge and skills related to the market with the objective of improving the quality of agricultural production to compete in the market particularly in the global market.

- Organization of Farmers' Interest Groups (FIGs) on commodity basis and building their capabilities with regard to management of their

farm enterprise.

- Supporting and enhancing the capacities of locally established groups under various schemes/ programmers like watershed committees, users groups, SHGs, water users associations. These groups need to be educated on the importance, utility and benefit of self-help action.
- Enhancing the interactive and communication skills of the farmers to exchange their views with customers and other market forces (middle men) for getting feedback and gain the bargaining during direct marketing.
- Establishing marketing and agro-processing linkages between farmers groups, markets and private processors.
- Providing advice on product planning in terms of selection of crops, varieties suitable to the land and marketability. This important role of offering information will be played by the Extension System.
- Educate the farming community to treat agriculture as an entrepreneurial activity and accordingly plan various phases of crop production and marketing.
- Direct marketing: farmers need to be informed about the benefits of direct marketing. In some of the states, Rytu Bazars in AP, ApniMandis in Punjab and Haryan and Uzavar Santhaigal in Tamil Nadu have shown success.
- Regular usage of internet facilities and production of video films of success stories to motivate farmers (Sharma & Chand, 2014).

**Challenges to Market Led Extension:** While initiating the Market Led Extension (MLE) the following challenges are to be kept in mind:

**Risk bearing:** In both the production and marketing of produce the possibility of incurring losses is always present. Market risks are those of adverse change in the value of the produce between the processes of production and consumption.

**Storage of farm produce:** Whether storage takes place on the farm or in silos off the farm, increases in the value of products due to their time utility must be sufficient to compensate for costs at this stage, or else storage will not be profitable. These costs will include heating, lighting, chemical treatments, store management and labour, capital investment in storage and handling equipment, interest charges and opportunity costs relating to the

**Table 2: Some additional roles of extension personnel in light of market-ledextension**

	<b>Strengths</b>	<b>Weaknesses</b>	<b>Opportunities</b>	<b>Threats</b>
<b>SWOT analysis</b>	Demand High marketability Good price	Less demand Poor marketability Poor price	Export to other places Appropriate time of selling	Imports of products Perishability of the products

capital tied up in stocks. Among the less tangible costs is the risks attached to storage. These include shrinkage due to pilferage, pests, fungal growths and loss of quality due to ageing. Another risk is that demand could fall with adverse effects on prices.

**Grading:** It is important to have a grading system, which accurately describes products in a uniform and meaningful manner. Grades and standards contribute to operational and pricing efficiency by providing buyers and sellers with a system of communicating price and product information. By definition, commodities are indistinguishable from one another. However, there are differences between grades and this has to be communicated to the market. By the same measure, buyers require a mechanism to signal which grades they are willing to purchase and at what premium or discount. Prices vary among the grades depending upon the relative supply of and demand for each grade. Since the value of a commodity is directly by its grade, disputes can and do arise.

**Standardization:** is concerned with the establishment and maintenance of uniform measurements of produce quality and /or quantity. This function simplifies buying and selling as well as reducing marketing costs by enabling buyers to specify precisely what they want and suppliers to communicate what they are able and willing to supply with respect to both quantity and quality of product. In the absence of standard weights and measures trade either becomes more expensive to conduct or impossible altogether

**Processing:** Most agriculture produce is not in a form suitable for direct delivery to the consumer when it is first harvested. Rather it needs to be changed in some way before it can be used. Of course, processing is not the only way of adding value to a product. Storing products until such time as they are needed to add utility and therefore, add value. Similarly, transporting commodities to purchasing points convenient to the consumer adds value. In short, any action, which increases the utility of the good or service to prospective buyers, also adds value to that product or service.

**Adoptions of Information Technology:** Rapid changes in the Information Technology and need for collection of relevant information thereby making the farmers info-rich

**Financing:** In almost any production system, there are inevitable lags between investing in the necessary raw materials (e.g. machinery, seeds, fertilizers, packaging, flavorings, stocks, etc.) and receiving payment for the sale of produce. During these lag periods some individual or institution must finance the investment. The question of where the funding of the investment is to come from, at all points between production and consumption, is one that marketing must address (*Anonymous, 2013*).

**Dimensions of Market-Led Extension**

*Marketing mix*

- **Product:** The first "P" of the marketing mix deals with the product. The positioning, packaging, etc. what is it that you are going to sell.
- **Price:** It is refers to value of product .Pricing Methods depends on ,competition in the market and your marketing strategies ,demand for your product ,controlled pricing and your costs
- **Place:** Product placement-the width of distribution Location-the place of the business "locate your business where the market is".
- **Promotion:** Advertising and Promotion - are aimed at making potential customers aware of the existence of your business, your product and services and to encourage them to buy from you (*Anonymous, 2014*)
- **Marketing plan:** It is a blue print of marketing objectives, opportunities and strategies to develop, price, promote and distribute the products of a firm to meet its organisational objectives (*Babu, 2007*).
- **Market intelligence:** The process of collecting, interpreting, and disseminating information relevant to marketing decisions is known as market intelligence. Market Intelligence is a process of giving you insights into what might happen in the near future.

**Need of Market Intelligence in agriculture**

**Table 4: Marketing mix**

4 P's	4 C's
a. Product	a. Customer solution
b. Price	b. Customer cost
c. Place	c. Customer convenience
d. Promotion	d. Communication

**Table 3: Problems associated with market led extension**

Production related	Market related	Extension related
Seasonality of production: Supply not uniform	Non-availability of MI: Lack of information about the market	Lack of communication skills
Perishability of produce: Problem of storage facility like invalidity of proper storage facility.	Existence of middleman: Too many market functionaries.	Lack of credibility
Bulkiness of production: Transportation problem	Inferior quality of produce	Insufficient information related with market

Source: Kumar et al. (2012)

**Table 5: Some successive entrepreneurs using market-led extension**

Name of the self help group	Name of the farm women	Products
Global self help group	Gurdev Kaur (AyaliKhurd)	Honey Bee, Pickel, Saag Ready to Cook, Ready To Serve
Asal self help group	Nasib Kaur (Bathinda)	Honey Bee, Pickel, Saag Ready to Cook, Ready To Serve
Mai bhago self help group	Parmjit Kaur (Lohara)	Cleaning agent, Soya Product
Mata sindri self help group	Karmjit Kaur (Bains)	Honey Bee, Saag Ready to Cook, Ready to serve

- Reduce the level of risk in decision-making
- Seller finds out what the customer needs and want
- What products are right for the market □
- What will be the price □

**Scope of IT application in agriculture marketing:**

Agriculture produce marketing requires connectivity between the market and exporters/ growers/ traders, industry consumers, through wider network of national and international linkages in order to provide day to day information with regard to commodity arrivals and prevailing rate etc. to provide links for on line international market information, to provide export related documentation, to inform about the latest research in agriculture marketing, packaging, storage related information and to provide connectivity with lead international and national market organizations.

**Sources of marketing information:** News paper, magazine, radio, television, telephone, etc.

**Websites for market information:** A grisurf, NETVET, Agriwatch, Commodity India, Agfind, A gmarket, Hortiindia, APEDA, NCDEX, e-CHOUPAL, etc. (Rathakrishnan et al., 2009)

**Opportunities of Market-Led Extension:** The various opportunities of mark led extension include

**Tapping the new trends:** It refers to adopting new trends in market-led extension so as to get maximum returns to the farmer viz. garbling new market.

**Supply chain Management:** It represents the augment of the entire set of production, transformation, distribution and marketing activities by which a consumer is supplied with a desired product. SCM provides a incense to conceptualize management of the changes required in the system to efficiently respond to consumer needs, based on integration and coordination of the efforts of all the business units involved in the production and delivery processes. Effective SCM results in lower transaction costs and increased margins for which supply chain parties are work together with interdependence. Thus, open communication and mutual benefits. The major stakeholders of SCM are;

- Customers
- Retailers
- Wholesalers /Distributors Manufacturers

**Contract Farming:** Contract Farming is essentially an agreement between the primary producer and agribusiness firm to procure certain pre-agreed quantity and quality of a produce at particular time and price (Eaton & Shepherd, 2001)

**Direct marketing:** It is the use of consumer-direct channels to reach and deliver goods and services to customers without using market middleman, wholesalers, advertisers and retailer. Successful Models of Direct Marketing are Tamil Nadu-Uzhavar Sandhai, Andhra Pradesh-Rythu Bazaars, Punjab-Apni Mandi, Odisha-Krushak Bazaars, Maharashtra-Shetkari Bazaars, Karnataka: Raitha Santhe (Anonymous, 2014).

**CONCLUSIONS**

Market-led extension system establishes its position by helping the farmers realize high returns for the produce and minimize the production costs and improve the product value and marketability. Information technology, electronic and print media need to be harnessed to disseminate the production and market information Indian farmers have moved from subsistence to self-sufficiency due to advent of production technologies. In order to be successful in the liberalized market scenario they have to shift their focus from 'supply driven' to market driven' and produce according to the market needs and earn high returns.

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## Farmers' Knowledge on Organic Manures and Crop Residue Management in Haryana

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### ABSTRACT

People are now talking of organic agricultural inputs for sustainable agriculture. The poor production/stagnant production with poor soil health is because of low application of organic manures and crop residues. To mitigate these harmful effects, the concept of organic farming has emerged. It is a production system, which favours maximum use of organic materials like crop residues, FYM, compost, green manure, oil cakes to improve soil health. The analysis indicated that knowledge percentage about organic manures and crop residues was found 65.57 per cent. Knowledge of farmers among various organic manures and crop residues aspects, the 'time and quantity of farm yard manure required' ranked first.

### Keywords

Crop residue, knowledge, organic manures, organic paddy farming, soil fertility

### JEL codes

D83, O13, P28, Q01, Q53

### INTRODUCTION

Environmental pollution and food safety due to chemical contamination have become a great global concern worldwide. Food and Agriculture Organization (FAO) proposed The World Food Summit Plan of Action, 1999 in recognition with the importance of developing alternative sustainable agriculture such as organic farming. Switching to organic and resource-conserving methods of farming can improve crop yields, ensure food security and enhance income. Organic farming seems to be more appropriate, it considers the important aspects like sustainability of natural resources and environment. It is a production system which favours maximum use of organic materials (crop residue, animal residue, legumes, on and off farm wastages, etc.). The interest in organic agriculture is growing because of its more reliance on the available natural resources. It uses traditional and indigenous farming knowledge. Thus through greater emphasis on use of local resources and self-reliance, conversion to organic agriculture definitely contributes to the empowerment of farmers and local communities.

Perhaps, for the first time in the history of Indian

agriculture a goal of doubling of income of farmers in six years ahead is set. We are grateful to our farmers for being the backbone of the country's food security. We need to think beyond food security and give back to our farmers a sense of income security. Government will, therefore, reorient its interventions in the farm and non-farm sectors to double the income of the farmers by 2022. (Finance Minister Arun Jaitley, Budget Speech, February 29, 2016). Farmer's income can increase through increasing total output and their prices, reducing production costs through lowering input use and/or reducing input prices, diversifying production mix towards more remunerative enterprises and providing earning opportunities in non-farm sector. Reduction in costs again is not possible through price-reduction route. Best option is by reducing input use which is possible in organic agriculture. Large scale adoption of practices such as System of Root Intensification (SRI), Low External Input use and Sustainable Agriculture (LEISA) and various other methods such as precision farming, organic farming, Natueco farming and so on (Satysai & Bharti, 2016)."The government is focusing not only on increasing crop yields

but also on reducing the cost of cultivation to increase the net income of farmers. The Prime Minister Mr. Narendra Modi regretted that for the sake of higher yield, massive doses of chemicals and harmful fertilisers were used. "This atrocity on 'dhartimata' should be avoided...we have no right to commit such an atrocity".

Increased price of chemical fertilizers have enabled organic wastes to regain an important role in the fertilizer practices on the farm. Good manure management means improved fertilizers value of manure and slurry and less nutrient losses. Composting of all organic wastes in general and of Farm Yard Manure (FYM) or feedlot manure in particular is important in organic farming. Integrated Intensive Farming System (IIFS) involves intensive use of farm resources. To be ecologically sustainable, such intensification should be based on techniques which are knowledge intensive and which replace to the extent possible, market purchased chemical inputs with farm grown biological inputs. FYM, farm compost, night soil, sludge and green manure are bulky in nature and supply large quantities of organic matter. Singh *et al.* (2016) concluded that application of organic manure either city compost or FYM alone or in combination with 50% NPK significantly increased yield attributes, yield and quality (protein) of paddy.

Concentrated organic manures are those materials that are organic in nature and contain higher percentage of essential plant nutrients such as nitrogen, phosphorus and potash as compared to bulky organic manure. The concentrated manures are made from raw materials of animal or plant origin. The concentrated organic manure commonly used are oil-cakes, blood meal, fish meal, meat meal and horn and hoof meal. Raw organic materials such as crop residues, animal wastes, green manures, aquatic plants, industrial wastes, city wastes, food garbage etc. enhance their suitability for application to the soil as a fertilizing resource.

Keeping in view the focus of government to promote organic farming that has an important role to double the farmers' income, change in dietary pattern and health consciousness of educated population the study was conducted to examine farmers' knowledge on organic manures and crop residue management in Haryana state.

#### METHODOLOGY

Haryana being the important contributor to the Basmati export state of India was selected purposively. Three districts viz., Kaithal, Karnal and Kurukshetra were also purposively selected since these districts have maximum area as well as production of rice. Siwan, Karnal and Pehowa blocks were randomly selected from Kaithal, Karnal and Kurukshetra districts, respectively. From each selected block two villages Siwan and Kangthali from Siwan, Kachchwa and Kunjpura from Karnal, Seonsar and Kamoda from the Pehowa blocks were selected randomly. Further, from each selected village, 25 farmers were selected randomly and in this way a total number of 150 respondents were interviewed

to ascertain the constraints faced by them in organic paddy cultivation. The data were collected through a pretested well-structured personal interview schedule.

#### Knowledge Level of Organic Paddy Farmers

Knowledge occurs when an individual is exposed to an innovation's existence and gains some understanding of how it functions. Knowledge seeking is initiated by an individual and is greatly influenced by one's predispositions. An individual tends to expose to those ideas which are consistent with one's existing attitudes and beliefs. A need can motivate an individual to seek information about an innovation and the knowledge of an innovation may develop the need. Knowledge is pre requisite to the adoption of an innovation. The final decision of farmers to use a new practice is usually the result of their knowledge of the practice and attitude towards it.

Pattanapant & Shivakoti (2009) concluded that knowledge is one of the key factors for the development of organic agriculture.

#### Knowledge Level of Farmers with respect to Organic Paddy Farming

The knowledge score of the farmers ranged from 22 to 70 having mean knowledge score of 49.19 against maximum possible score of 82. The farmers were further classified into three different categories 'low', 'medium' and 'high' on the basis of their knowledge score. It is evident from the data in Table 1 that slightly less than half of the farmers (48.00 per cent) were falling in medium category followed by high knowledge level category farmers (35.33 per cent), whereas about one-sixth of the farmers (16.67 per cent) were having low level of overall knowledge of organic paddy farming practices. This implies that majority of respondents were having medium level of overall knowledge regarding organic paddy farming practices.

**Table 1: Knowledge level of farmers with respect to organic paddy farming**

(N = 150)			
Category	Score range	Number of farmers	Percentage of farmers
Low	22-37	25	16.67
Medium	38-54	72	48.00
High	55-70	53	35.33

A medium level of knowledge about organic farming had been reported by Kumar *et al.* (2014), Jaganathan *et al.* (2012), Bisen & Sharma (2013); Meena *et al.* (2012). While, Rezvanfar *et al.* (2012) reported low level of knowledge.

#### District wise Knowledge Level of Farmers with respect to Organic Paddy Farming

Further analysis of knowledge level at district level (Table 2) indicated that among low level (40.00 per cent) farmers belonged to Kurukshetra district, among medium level (40.28 per cent) farmers belonged to Kaithal district

and among high level (37.74 per cent) farmers belonged to Karnal district.

The analysis revealed that comparatively Karnal district farmers possess more knowledge on organic paddy farming practices. The farmers of Karnal district possessed first position in each and every context. They seem to be very much progressive, innovative and cosmopolitan in nature and hence always ready to take risks. This might be possible due to better economic condition and that the Karnal city is geographically very well placed on one of the oldest and longest national highway and is near to the nation's capital in comparison to the other two districts.

### Knowledge Level of Farmers with respect to Various Aspects of Organic Paddy farming

To ascertain the level of knowledge possessed by the farmers with respect to various practices/aspects of organic paddy farming, their mean knowledge score were worked out, knowledge percentage were also computed and divided into low, medium and high knowledge categories. On the basis of knowledge scores and

percentages, the various aspects were accorded different ranks. The results have been presented in Table 3.

The Table 3 indicated that knowledge percentage about organic manures and crop residues in organic paddy farming was found 65.57 per cent and accorded second position in ranking order. The study brought to surface that 49.30 per cent of respondents had high level of knowledge, followed by 36.00 per cent had medium level and 14.70 per cent had low level of knowledge about use of organic manures and crop residues practices in organic paddy farming.

Knowledge regarding use of organic manures and crop residues found the same second rank in the study conducted by Suman (2012). Most of farmers used more organic matters (e.g. animal manure, plant manure, and kitchen waste) to fertile their plants. The acceptable yield levels along with superior quality, scented rice could be obtained due to application of organic source of nutrients. Special attention is to be paid to exploit full yield potential of the crop through proper inclusion of suitable organic farming practices (Tiwari & Mahajan, 2016). It is

**Table 2: District-wise knowledge level of farmers with respect to organic paddy growing**

(N = 150)

Category of knowledge	Score range	No of farmers	Number of farmers		
			Kaithal (n <sub>1</sub> =50)	Kurukshetra (n <sub>2</sub> =50)	Karnal (n <sub>3</sub> =50)
Low	22 – 37	25	7	10	8
Medium	38 – 54	72	29	21	22
High	55 – 70	53	14	19	20

Figures in the parentheses are percentage

**Table 3: Knowledge level of farmers with respect to various aspects of organic paddy farming**

(N = 150)

Aspect	Category	Score range	Frequency	Percentage	Mean	Percentage	Rank
Knowledge about concept of organic paddy farming	Low	0.0 to 3.0	20	13.30	5.13	64.13	III
	Medium	3.1 to 5.0	51	34.00			
	High	5.1 to 8.0	79	52.70			
Use of organic manures and crop residues	Low	0.0 to 5.0	22	14.70	9.18	65.57	II
	Medium	5.1 to 10.0	54	36.00			
	High	10.1 to 14.0	74	49.30			
Use of bio fertilizers	Low	0.0 to 4.0	19	12.70	5.37	44.72	VI
	Medium	4.1 to 8.0	70	46.70			
	High	8.1 to 12.0	61	40.70			
Vermicompost	Low	0.0 to 2.0	27	18.00	4.51	75.17	I
	Medium	2.1 to 4.0	54	36.00			
	High	4.1 to 6.0	69	46.00			
Weed management	Low	0.0 to 4.0	24	16.00	7.67	63.89	IV
	Medium	4.1 to 8.0	75	50.00			
	High	8.1 to 12.0	51	34.00			
Pest management	Low	0.0 to 10.0	32	21.30	18.70	62.33	V
	Medium	10.1 to 20.0	69	46.00			
	High	21.1 to 30.0	49	32.70			

**Table 4: Knowledge level of farmers with respect to organic manures and crop residues**

Statements	Knowledge level			Total weighted score	Weighted mean score	Rank order
	Full (Per cent)	Partial (Per cent)	No (Per cent)			
Time and quantity of FYM required	115 (76.67)	29 (19.33)	6 (4.00)	259	1.73	I
Right method of FYM application	82 (54.67)	37 (24.67)	31 (20.67)	201	1.34	III
Accurate method of FYM preparation	78 (52.00)	38 (25.33)	34 (22.67)	194	1.29	V
Incorporation of crop residues in the soil	45 (30.00)	78 (52.00)	27 (18.00)	168	1.12	VI
Organic/solid waste management	67 (44.67)	25 (16.67)	58 (38.67)	159	1.06	VII
Land preparation by non-burning vegetation	73 (48.67)	56 (37.33)	21 (14.00)	202	1.35	II
Incorporation stage of green crop	69 (46.00)	57 (38.00)	24 (16.00)	195	1.30	IV

Figures in the parentheses are percentage

essential to make farmers aware of the benefits of organic farming. Department of agriculture had launched a massive programme on organic farming resulting into a considerable success in dissemination of organic paddy farming technology. Farmers have acquired significant knowledge and adopted these practices but still there are gaps which need to be plugged.

**Knowledge level of farmers with respect to organic manures and crop residues**

From the data presented in Table 4 it is clear that knowledge level of farmers with respect to organic manures and crop residues, 'time and quantity of farm yard manure required' ranked first with highest mean score of 1.73.

Interesting to note that, 115 respondent farmers i.e. 76.67 per cent possessed full knowledge. Further, 'land preparation by non-burning vegetation' was ranked second with the mean score of 1.35 and 'right method of farm yard manure application' ranked third (mean score of 1.34) followed by 'incorporation stage of green crop', 'accurate method of farm yard manure preparation' and 'incorporation of crop residues in the soil' were ranked fourth, fifth and sixth with a mean score of 1.30, 1.29 and 1.12, respectively. The seventh and the last ranked factor was 'organic/solid waste management' with mean score of 1.06.

Nutrient losses from erosion and crop harvest could be recovered through use of FYM/compost and incorporation of crop residue (Tiwari *et al.*, 2009). Smith *et al.* (2007) also reported that proper incorporation of the FYM into soil could be effective for minimizing nutrient losses.

The findings of the study with regard to organic

manures and farm yard manure are in line with Borthakur *et al.* (2015) who reported high knowledge regarding farm yard manure while Bisen and Sharma (2013) mentioned average knowledge of the farmers on organic manures. Increasing prices of chemical fertilizers have enabled organic wastes to regain an important role in the fertilizer practices. Though farmers have ranked organic waste management as last i.e. they are not composting kitchen and other waste as such but in routine have the habit to use it as animal feed. The implication of the study is that the farmers had good knowledge of organic farming which would influence them towards a favourable perception of organic farming. It would also help the farmers shift to organic paddy production, if they are encouraged and motivated, since they have started practicing organic paddy farming.

The best stage of incorporation of green manures is the flowering stage i.e. before they mature or attain stiffness or hardness. The young and tender plants get easily decompose leaving thereby a little residue in soil. The organic manures are usually applied as basal dressing before main crop is sown.

Organic farming encourages the practice of crop rotation and ultimately the crop rotations along with use of manures maintain soil fertility. Thus carefully managed soils with high proportions of humus offer essential advantages with respect to water retention, ion exchange, soil erosion and microbial activities in the soil. A high portion of humus in the soil gives uniform distribution of nutrients and also plant hygiene (Ital, 2007).

Cropping intensification without adequate restoration of soil fertility may threaten the sustainability of agriculture (Roy *et al.* 2003). Hence, options to increase

Table 5: Knowledge of farmers of all three districts on various aspects

(N=150)

Aspects	Mean knowledge score $n_i=50$			'Z' Value		
	Kaithal (KT)	Kurukshetra (KK)	Karnal (KL)	KT & KK	KT & KL	KK & KL
Knowledge about concept of organic farming	4.95	5.10	5.35	1.21	1.44	0.88
Organic manures and crop residues	8.70	9.00	9.80	1.08	1.57	1.59
Use of Bio fertilizers	5.42	5.37	5.30	1.16	1.96*	1.01
Vermicompost	4.60	4.20	4.82	0.65	0.66	1.36
Weed management	5.17	5.45	5.50	1.12	1.99*	1.78
Pest management	18.10	20.17	19.75	2.02**	1.37	0.95
Overall knowledge	46.94	49.29	50.52	1.59	1.83	0.98

farm income while minimizing nutrient losses in the existing farming system is urgently needed to uplift the economy and well-being of the farmers of the country.

The implication of the study is that the farmers had good knowledge of organic farming which would influence them towards a favourable perception of organic farming. It would also help the farmers shift to organic paddy production, if they are encouraged and motivated, since they have started practicing organic paddy farming.

#### Knowledge of farmers of all three districts on various aspects

The data were analyzed to see if any significant difference existed in the knowledge level of the respondents among the three districts. Aspect wise mean knowledge score of the farmers of all the three districts were calculated and 'Z' test was applied to ascertain the difference (Table 5).

Organic farmers of Karnal district were having higher mean knowledge of concept of organic farming, organic manures and crop residues, vermicompost and weed management in comparison to the farmers of other two districts. While assessing the knowledge of farmers of all the three districts on various aspects of organic paddy growing no significant difference was observed regarding organic manures and crop residues between the farmers of three districts.

#### CONCLUSIONS

The organic sector is in embryonic stage while extension services are relatively hibernated resulting in lower than expected yields, especially during the initial years of production. Many producers start producing organically on a 'trial and error' basis, and adjust their farming methods every season until they reach an acceptable and stable level of output. It is suggested that maintaining the soil nutrient balances and increasing farm income through integrated nutrient management such as application of FYM/compost could be most appropriate. FAO (2013) admonished that as farmers become more yield oriented, so extension workers need to be in a position to advise them not only on how to grow crops but also on how to conserve the soil for future

yields. There is a need for all stakeholders to work together. Farmers' organization may be an essential part of a sound organic farming strategy with a sound alternate economic use of crop residues. Awareness and training programmes for organic farming at a regular interval are required. Farmers are not aware of advantage of non-traditional organic manures such as poultry manures, urban wastes etc. The use of organic manures can be improved substantially.

Unfortunately no government support exists during the period of conversion, a practice that is common i.e. to provide incentives to farmers to convert and keep them going ahead. Although number of organic consumers is increasing gradually these days, the number is still limited to justify commercial production with certification. Private initiation and motivation by some of the NGOs are the key impetus in bringing organic sector in the mainstream agriculture development. There is virtual lack of government support to the organic growers and marketers.

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## Impact of KVK's Home Science Training Programme in Rural Development

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### ABSTRACT

Study was conducted at Krishi Vigyan Kendra (KVK) Ferozepur district of Punjab. The KVK has been conducted Vocational/short term and In-service trainings for rural youth/farmers and extension functionaries. The present study was focused on Impact of Home Science trainings organized by KVK ferozepur. The suggestions of trainees were also taken for making improvements in future training programmes. A total of 125 trainees who have attended training programme were selected as the respondents of the study. The findings revealed that more than 62 per cent respondents were belonging to young age group and about 92 per cent respondents were educated. More than half of the respondents were belong to landless & schedule caste families. Majority of the trainees had adopted the vocational training on domestic level. About 80 per cent of the trainees who have received stitching training had adopted the occupation on self sustainable level and only 13.3 per cent had adopted as commercial level. Same trend was found in fruits and vegetable preservation training on other hand 16.6 per cent of the trainees had adopted the dying on commercial scale and 45 per cent of the trainees adopted as self sustainable level. It indicated that these training had positive monetary impact on the life of the trainees as they started earning money (who adopted on commercial scale) and others added to their family income by saving money by doing their own work rather than getting it done by others and the suggestions given by the trainees can be a good feedback for the extension personnel for planning of training programmes in future.

### Keywords

Adoption, impact, suggestion, training

### JEL Codes

C83, D24, D83, M53

### INTRODUCTION

Training means to bring about continuous improvement in quality of work performed by the individuals. It should equip the trainees with necessary knowledge, skills or abilities and attitude to perform the job. So, training is an important tool to bring improvement in the skills of the individual and apply it to the performance of his or her specific work situation. In order to achieve gender equality, it is very important to support women with information, training and technology. One of the important mandate of KVK's is to impart trainings to rural youth/farm women so that they can become self-employed and raise the socio-economic standard of their family, ultimately of the society.

Impact assessment has emerged as an important aspect to measure the effectiveness of training programmes for the improvement of livelihood and living standards of

people in order to bring a more sustainable change. Along with qualitative effects of programmers it also measures the extent to which its goals are attained, so that suitable changes can be made to make the programme more effective. Keeping in view, the present study was undertaken at KVK Ferozepur with following objectives:

- a. to know the socio personal characteristics of the trainees,
- b. to find out impact of various vocational training programmes conducted in the discipline of home science, and
- c. to study the satisfaction level of trainee regarding various aspect of occupation.

### METHODOLOGY

KVK Ferozepur organized different trainings for the farm women like cutting and stitching of garments,

Preservation of fruits and vegetables, fabric painting and soft toys making etc. and an ex-trainees sammelan were organized at KVK, Ferozepur, in which Home Science trainees who had acquired vocational trainings on above said fields were invited. The data regarding the impact of various H.Sc. Training was collected from 125 ex-trainees through questionnaire method. The independent and dependent variables were selected: the independent variables like age, education, marital status, family occupation, land holding and category were taken. Impact was studied in terms of adoption of the occupation and satisfaction of the occupation. The collected data were processed, tabulated, classified and analyzed in terms of percentage in light of the objective of the study.

**RESULT AND DISCUSSION**

**Socio-personal Characters**

**Age:** It was revealed form the Table 1 that majority (62.4 per cent) of the trainees were belonged to age category 18-28 years and 25.6 per cent of the trainees were in 28-38 years age group and 12 per cent trainees were in the old age category. It clearly shows that the risk taking and enthusiasm for new innovation adoption always lies within the young generation of the society.

**Education level:** As depicted form the Table 1, about 92 per cent of the respondents were educated and only 8 per cent of the trainees were illiterate. Out of the educated trainees 74 per cent had education level primary to metric

and 14 per cent had up-to senior secondary level.

**Marital status:** As observed form the Table 1, about two-third of the trainees were married and 38 per cent of them were unmarried.

**Family occupation:** A perusal of the Table 1 revealed that most of the trainees were from landless farming families as clear from the fact that the family members of these trainees were working as agricultural labourer (58 per cent), while 31 percent of the respondents were doing farming. A very few of them do the service as occupation.

**Land holding:** Very surprisingly majority of the trainees (68.8 per cent) were from landless and marginal farming families and only 24 per cent of the trainees were from small and large farming families.

**Category:** The data placed in Table1 depicts that good numbers (59 per cent) of trainees were from Schedule castes category which was an encouraging factor for the extension functionaries. This might be the major reason that majority of the families belong to landless farming families.

As it is revealed form the Table 2, most of these trainees had received one or more trainings on different aspects. About 60 per cent of the trainees had training on Stitching, 20 per cent trainees received training on fabric painting, 12 per cent of them had training on interior decoration, around 28 per cent of the trainees received training on fruits and vegetable preservation, around 14 per cent of the trainees received training on soft toys making and about 29 per cent received training on Dyeing of clothes.

As evident from the Table 3 that majority of the trainees had adopted the vocational training on domestic level. Data in table revealed that about 80 per cent of the trainees who have received stitching training had adopted the occupation on self sustainable level means for his house hold level and only 13.3 per cent had adopted as commercial level because they have less resources and cannot afford to spend more income on commercial level. Same trend was found in fruits and vegetable preservation training on other hand 16.6 per cent of the trainees had adopted the dying on commercial scale and 45 per cent of the trainees adopted as self sustainable level. Furthermore 60 per cent of the trainees had adopted fabric painting at domestic level and only 12 per cent adopted fabric painting at commercial level. Small number of trainees (16.6 per cent) had adopted the soft toy making on

**Table 1: Socio personal characteristics of the trainees**

Category		No. of participants	Percentage
Age	18-28 years	32	25.6
	28-38 Years	78	62.4
	38-48 years	15	12.0
Education	Illiterate	10	8
	0-5 years (Up-to primary)	35	28
	6-10 (Up-to Metric)	58	46
	11-12 (UP-to senior secondary)	17	14.0
	Graduation	5	4.0
Marital status	Married	78	62
	Unmarried	47	38
Family occupation	Farming	39	31
	Service/private	12	9.6
	Labour class	74	58.4
Land holding	Landless	86	68.8
	Small (1-2 ha)	30	24
	Medium (2-4 ha)	7	5.6
Category	Large (> 4ha)	2	1.6
	Schedule caste	74	59
	Other backward class	0	0
	General	51	41

**Table 2: Training received by the trainees**

Title of the training course	No. of participants*	Percentage
Stitching of garments	75	60
Fabric painting	25	20
Interior decoration	15	12
Fruits and vegetables	35	28
Soft Toy making	18	14
Dyeing of clothes	36	29

\*Multivariate responses

Table 3: Training adopted at commercial/self-sustainable level by the trainees

Type	No of respondents*	Self-sustainable		Commercial	
		Number	Percentage	Number	Percentage
Stitching of garments	75	60	80	10	13.3
Fabric painting	25	15	60	3	12
Interior decoration	15	5	27.7	2	11
Fruits and vegetables	35	28	80	5	14.2
Soft toy making	18	16	44.4	6	16.6
Dyeing of clothes	36	3	20	0	0

\*Multivariate responses

commercial scale. It indicated that these training had positive monetary impact on the life of the trainees as they started earning money (who adopted on commercial scale) and others added to their family income by saving money by doing their own work rather than getting it done by others. It is further reported by the trainees that they adopted the occupation on professional level within no time after completing the training. It has also been reported by Joseph & Padaria (2007); Singh *et al.* (2013) that the KVK training programme had a positive impact in enhancing the maize yield and by Chapke *et al.* (2006) have also reported that the training had a positive impact on increasing the understanding and knowledge regarding different aspects of course of content studied. Venkattakumar (2010) also revealed in his study that majority of the cashew growers had medium level of adoption and Singh *et al.* (2013) also reported in their study that majority of the farmers (75.62%) adopted scientific rice cultivation practices.

Majority of the trainees were satisfied from their new occupation like stitching, fabric painting, interior decoration, fruits and vegetables, etc. and wanted to expand their business by taking loans and forming self-help groups. About 52 per cent of them were not satisfied from the income as the level of work is confined to domestic only that's why they wanted it to expand. Majority of the trainees were satisfied from the nature of the work as the work is performed at home and they did not have to go anywhere and were able to adjust according to the free time available. About the acceptance of the family around 70 per cent were satisfied to somewhat satisfied that was also depicted from the family support (Table 4).

As observed from the Table 5 that majority of them adopted skills received during various training programmes, so they had a positive view about the training programmes and gave their very valuable suggestions. About 89.6 per cent of the respondents felt that there is need for inclusion of stitching of gents garments in the training course so as to help in expanding their enterprise and rank it as 1<sup>st</sup> in terms of the training required. Similarly, 78.4 per cent ranked 2<sup>nd</sup> for training on Fashion Designing followed by training on toy making by 76.8 per cent,

training on Embroidery by 69.6 per cent, training on Painting and candle making by 65.6 and 64.0 per cent have given their choice to attend training on modern stitching machines and more material for decoration. These suggestions were incorporated while planning training programme in future. Chapke (2010) also revealed in his study that majority of the farmers were satisfied from the results of the front line demonstrations of jute.

#### CONCLUSIONS

From the sample of one hundred and twenty five trainees from KVK Ferozepur more than half of the respondents were belong to young age group, educated, landless & schedule caste families. About 80 per cent of the trainees who have received stitching training had adopted the occupation on self sustainable level and only 13.3 per cent had adopted as commercial level because they have less resources and cannot afford to spend more income on commercial level. Same trend was found in fruits and vegetable preservation training on other hand 16.6 per cent of the trainees had adopted the dying on commercial scale and 45 per cent of the trainees adopted as self sustainable level. It indicated that these training had positive monetary impact on the life of the trainees as they started earning money (who adopted on commercial scale) and others added to their family income by saving money by doing their own work rather than getting it done by others. The suggestions given by the trainees can be a good feedback for the extension personnel for planning of training programmes in future.

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## **Growth, Demand and Supply of Quality Seeds of Pulses in India**

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### **ABSTRACT**

*The secondary data on area, production and productivity, seed availability and requirement of pulse crop were collected from various sources and analysed by using compound growth rate. The study revealed that the net availability of pulses per person was come down from 69 to 47.20 gram per day per person to during study period. The study shows that positive growth in area, production and yield of all pulses whereas negative growth observed in area and production of lathyrus and kulthi crops. The study shows that almost all pulses crops have gap in availability and supply of quality seeds except in Bengal gram during the year 2010-12 and 2013-14.*

### **Keywords**

Availability, growth rate, production, requirement

### **JEL Codes**

Q11, Q12, Q16, Q18, Q56

### **INTRODUCTION**

The country has advanced from a situation of food scarcity and imports to that of food security. The landmark achievements in agriculture in the 60s and 70s were the result of a combination of inputs like introduction of high yielding varieties, increased fertilizer use, expansion of irrigation facilities, massive extension efforts, improved farm practices and, above all, ingenuity and industry of the Indian farmers. The growth of agriculture sector has not growing as the rate of growing population, while look on to the population which has fastest growing. India has high population pressure on land and other resources to meet its food and development needs. Therefore, the natural resource base of land, water and environment is under severe pressure. With the scarce available resources for production, declining factor productivity in major pulse crops, consequently the meeting food demand was major challenge for our country. Pulse crops have a unique role to play in the global nitrogen cycle, pulse fix atmospheric nitrogen in soils. The introduction of pulses into crop rotations actively helps to fix nitrogen in the soil and also reduce the greenhouse gas (GHG) emission to the environment from

subsequent crops, therefore it maximize the environmental benefits.

Indian, Canada, China, Brazil and Australia are the major pulse producers in the world. India is ranked as the largest producer which accounting 17.56 million tonnes, importer and consumer of pulses in the world accounting for nearly 25 per cent of global production, 15 per cent of international trade and 27 per cent of world consumption during 2014-15. A significant percentage of India's total population of over 1.27 billion and growing at over 1.7 per cent per year (Anonymous, 2014-15) depends on pulses to meet their daily protein and calorie requirements. The important pulse crops in India are chickpea (43 per cent), pigeonpea (16 per cent), urdbean (10 per cent), mungbean (8 per cent), lentil (6 per cent), fieldpea (4 per cent) and others (13 per cent). The major pulse-producing states are Madhya Pradesh, Maharashtra, Rajasthan, Uttar Pradesh, Karnataka and Andhra Pradesh, which together accounts for about 80 per cent of the total production.

United Nations, recognizing protein deficiency as a global concern and the potential of pulses to address it designated across the world to declare 2016 as The International Year of Pulses. This year promises to be a

milestone development in global pulses trade that aims to focus attention on the role that pulses play as part of sustainable food production aimed towards global food security and nutrition. The IYP 2016 aims to increase public awareness of the nutritional benefits of pulses as part of sustainable food production aimed towards food security and nutrition (Anonymous, 2016). India, Canada, China, Brazil and Australia are the major pulse producers in the world. India is accounting for 25 per cent of world production during 2014-15.

Pulses are staple diet for most of the peoples for Indians are mainly due to vegetarian food habits. There was gap between meeting the demand of the growing population therefore to know the gap, thus the paper is an attempt to know the availability of pulse for per person over the time and to assess the gap between requirement and quality seed availability in major pulse crops in India, to provide credible estimates of growth in area, production and productivity of major pulse crops.

#### METHODOLOGY

The secondary data related the area, production, productivity, quality seed availability and requirement of major pulse crops in India were collected from Directorate of Economics and Statistics, various annual reports of Indian institute of pulses research (IIPR), India Pulses and Grains Association (IPGA) from publications and from Indiastat website. The time series data related to the area, production, productivity from 2001-02 to 2014-15. To measure gap between quality seed availability and requirement of major pulse crop data were collected from 2010-11 to 2014-15.

In order to assess the growth in area, production and productivity of major pulse crops for the fifteen years, an exponential function of the form.

#### RESULTS AND DISCUSSION

The imperative of national food security, nutritional security and economic development demand a very focused and determined approach to raise productivity and production in agriculture. In view of the fact, that the area under cultivation is unlikely to increase significantly, thrust will have to be on raising productivity per unit of cultivated land. The per capita availability of cereals has steadily increased from 417.3 gram per day per person to 444.1 gram per day per person from 1980s to 2014-15 (Table 1). Whereas, in case pulses the availability during 1960-61 was 69 gram per day per person that was come down to 47.2 gram per day per person in year 2014-15. This results also similar to that of Narayan & Kumar (2015) they revealed that, net per capita per day availability of pulses has fallen drastically 61 to 41 gram during 1951 to 1990, while rice has increased 159 to 212 gram and wheat 66 to 133 gram during the same period. The trends clearly indicate that the increase in per capita cereal production in the country, meanwhile there was decrease in availability pulses as as the population increases (NIN was recommended 60 g per day per person). This might be due to not faster growth trend in

**Table 1: Net availability of pulses and cereals**

Years	Population (Crores)	Per capita net availability(g/day)		Total (g/day)
		Cereals	Pulses	
1960-61	44.24	399.7	69.0	468.7
1980-81	67.52	417.3	37.5	454.8
1990-91	85.17	452.6	41.9	494.5
2001-02	103.32	386.2	30.0	416.2
2005-06	110.28	390.9	31.5	422.4
2006-07	111.98	412.8	32.5	442.8
2007-08	113.6	407.0	35.5	442.8
2008-09	115.31	394.2	41.8	436.0
2009-10	116.94	407.0	37.0	444.0
2010-11	118.58	401.7	35.4	437.1
2011-12	120.19	410.6	29.4	451.0
2012-13	121.34	408.6	41.7	450.3
2013-14	122.88	358.1	43.3	401.4
2014-15	124.41	444.1	47.2	491.2

Source: www.indiastat.com date access 10.8.2016

As per NIN recommendation 60 gram per day per capita for pulses

pulse production with respect to the growth of population.

The Government of India has taken several initiatives to motivate farmers to grow more pulses and to increase pulse production in the country. The area of pulses fluctuates from 2001-02 to 2014-15 with this fluctuation area has also led to increase from 22.01 million hectares to 23.55 million hectares (Table 2). There was noticed highest increase are under pulses 23.28 m. ha to 26.41 m. ha during the 2009-10 to 2010-11 respectively. Similarly the production also significantly increased during this period. This was due to significantly increase in minimum

**Table 2: Area, production and productivity of pulses in India (2001-02 to 2014-15)**

Years	Area (million ha)	Production (million tonnes)	Yield (Kg/ha)
2001-02	22.01	13.37	607
2002-03	20.50	11.13	543
2003-04	23.46	14.91	635
2004-05	22.76	13.13	577
2005-06	22.39	13.38	597
2006-07	22.39	14.20	612
2007-08	23.63	14.76	625
2008-09	22.09	14.57	659
2009-10	23.28	14.66	630
2010-11	26.41	18.24	691
2011-12	24.46	17.09	691
2012-13	23.26	18.34	789
2013-14	25.21	19.25	764
2014-15	23.55	17.15	728
CAGR	0.99	3.26	2.27

Source: www.indiastat.com date access 10.8.2016

support price by adding incentives prices of pulses.

Interestingly, the production was decreases 19.25 million tones to 17.15 million tones from 2013-14 to 2014-15 due to unfavourable weather and untimely heavy rains during this period of production and the pulse crops also suffered due to less rains during monsoon season in 2014. The productivity of pulses has significantly increased from 607 kg per hectare in 2004-05 to 728 kg per hectare in 2014-15.

Table 3 presented that CAGR of area, production, productivity of major pulses in India from 2001-02 to 2014-15. The highest growth in area can be observed for Bengalgram (3.10 per cent) followed by Redgram (1.37 per cent) and lentil (0.15 per cent). The area under lathyrus and kulthi was significantly decreasing at the rate of 4.76 per cent and 3.07 per cent per annum. Similarly the area under greengram and blackgram registered a negative growth. However, the increase in area under the lentil was almost negligible 0.15 per cent per annum non-significantly.

The growth in production of major pulses can observed from the Table 3 that a significant growth of 4.87 per cent for Bengalgram, 2.70 per cent for greengram, 2.25 per cent for redgram, 2.42 per cent for Blackgram and 0.93 per cent for Lentil. On the other hand, the negative growth registered under lathyrus and kulthi (-0.73 and -1.76per cent) but the productivity was notice that positive (3.15 and 2.37) it might be due to even in unpredictable condition these crops performed well, there for there is need to bring again the decreasing area under lathyrus and kulthi.

The gap between requirement and availability or use of quality seeds for major pulse crops from 2010-11 to 2014-15 depicted in Table 4. Whereas the gap for Bengalgram was account -1.18 lakh quintals for the year 2011-12 and also deficit gap during 2014-15. Similarly, in the case of peas the gap was deficient for all the four years

**Table 3: CAGR of area, production, productivity of major pulses in India for the triennium ending 2001-02 to 2014-15**

Major Pulses	CAGR (per cent )		
	Area	Production	Yield
Redgram	1.37**	2.25**	0.87 <sup>NS</sup>
Bengalgram	3.10**	4.87**	1.72***
Greengram	-0.21	2.70 <sup>NS</sup>	2.91 <sup>NS</sup>
Blackgram	-0.49	2.42***	2.93**
Lentil (Masur)	0.15 <sup>NS</sup>	0.93 <sup>NS</sup>	0.78 <sup>NS</sup>
Lathyrus	-3.07**	-0.73	2.37***
Kulthi	-4.76**	-1.76	3.15**

\*\*\* and \*\* significant at 1 and 5 per cent level

(-0.77,-0.14l, -0.23,-0.16, and-0.39lakh quintals). Whereas, in case of lentil there is no mismatch between requirement and availability seeds in the year 2010-11, but from 2011-12 onwards there was gap occurrence, the gap was deficiency for three years (-0.18, -0.30, 0.04l, and 0.41lakh quintals) respectively.

Similarly, the deficit gap was also seen in moth from 2010-11 to 2014-15, with respect to red gram the deficit gap exist during 2013-14 which was account 0.06 lakh quintals. This result was conformity with Murleedhar *et al.*, (2013) revealed that, among major production constraints, availability of quality seed of improved varieties has been a major constraint in enhancing production and productivity of pulses in India. The deficit gap for quality seeds availability appeared in major pulse crop was due to lack of private seed industry in production of seed. Quality seed acts as a prime mover to realize the potential of all other inputs. However, non-availability of quality seeds remains one of the greatest impediments in improving productivity (Singh & Pratap, 2015). It has well acquired technological strength to cater to the

**Table 4: Gap between requirement and availability of quality seeds in major pulses in India**

Crop	Particulars	2010-11	2011-12	2012-13	2013-14	2014-15
Bengalgram	Requirement	12.56	14.22	16.32	17.07	16.11
	Availability	15.33	16.63	15.14	20.1	15.72
	GAP	2.77	2.41	-1.18	3.03	-0.39
Peas	Requirement	1.79	1.5	1.83	1.8	1.96
	Availability	1.72	1.36	1.6	1.64	1.57
	GAP	-0.07	-0.14	-0.23	-0.16	-0.39
Lentil	Requirement	0.92	1.13	1.04	1.46	1.79
	Availability	0.92	0.95	0.74	1.42	1.38
	GAP	0	-0.18	-0.3	-0.04	-0.41
Redgram	Requirement	2	2.71	2.16	2.58	2.64
	Availability	2.03	3.55	2.27	2.52	2.78
	GAP	0.03	0.84	0.11	-0.06	0.14
Moth	Requirement	0.15	0.15	0.2	0.21	0.25
	Availability	0.06	0.09	0.23	0.17	0.14
	GAP	-0.1	-0.06	0.03	-0.04	-0.11

varietal needs of future. Sustained increase in agriculture production and productivity necessarily requires continuous development of new and improved varieties of crops and efficient system of production and supply of seeds to farmers. However, the use of high quality seed is the critical determinant of agricultural production on which depend the performance and efficacy of other inputs. Quality seeds appropriate to different agro-climatic conditions and in sufficient quantity at right time to raise productivity.

#### CONCLUSIONS

The secondary data related the area, production, productivity, quality seed availability and requirement of major pulse crops in India. The study reveals that the per capita net availability of pulses was marginally increased from 1960 to 2014. The study shows that the productivity of pulses has significantly increased from 607 kg per hectare in 2004-05 to 728 kg per hectare in 2014-15. The positive growth registered in production of all pulses except lathyrus and kulthi crops. The study shows that almost all pulses crops have gap between availability and supply of Quality seeds except in some crops. So, the government and other public sector agencies may undertake appropriate measures to provide sufficient quantity of quality seeds at right time increase the

production and productivity pulses crops.

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## Perceived Impact of the Stakeholders Regarding Agricultural Subsidies in Punjab

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### ABSTRACT

The agricultural subsidies have become an integral part of the farmer as well as the country's economy. The subsidies are provided to ensure equal utilization of the resources by all the section of farmers. But with time these subsidies have been criticized and the major question that has arisen in front of the policy-makers is that do we really need these subsidies? To answer this, we need to look on the positive and negative impacts of the agricultural subsidies and by far the negative impacts are more than that of positive impacts. This study tries to bring forth the perceptions of the stakeholders on the impact of agricultural subsidies in Punjab. The analysis was based on the survey of 180 farmers, 20 economists and 20 extension personnel all involved in the virtuous as well as the vicious circle of the working of agricultural subsidies. This analysis can serve as the base for rectifying the existing policies on these subsidies so as to encourage the farmers to remain in this sector and at the same time boost their socio-economic conditions then supporting their livelihoods.

### Keywords

Agricultural subsidies, inputs, perceived impact, stakeholders

### JEL Codes

C82, Q13, Q13

### INTRODUCTION

Agricultural subsidies were introduced to Indian farmers during the time of green revolution to facilitate cheap inputs such as high yielding variety seeds, fertilisers, pesticides etc. with two major objectives i.e. firstly to keep cost of the food grains at minimum and attain self-sufficiency in food and secondly to ensure income security of the farmers (Anonymous, 2014). At present in India, both central and state governments are providing subsidies to farmers of all section with the main targets towards small and marginal farmers. Out of these subsidies, the central government provides subsidies mainly on food and fertilisers and through price support schemes also. The subsidies on irrigation, electricity, seeds, plant protection materials, etc. have become the state government subjects (Kaur and Sharma, 2012). The economic and environmental impacts of subsidies have attracted considerable scientific and political interest (Lingard, 2002). Analysis of the environmental and economic impacts is exceedingly complex, but the results show that many are unquestionably damaging, for

example, the free electricity to the farm sector has acted as the precursor to the increase in the rice area, over-exploitation of groundwater and as an obstacle to diversification (Singh, 2012), overuse of fertiliser (urea) leading to loss in soil fertility (Grossman & Carlson, 2011), etc. Often subsidies, while attempting to benefit one economic area result in harming others to the extent that their net impact is negative (Ray, 1998). Agricultural subsidies, especially in the form of protecting incomes of farmers or reducing their input costs are clear examples. In the agricultural sector in particular, subsidies that stimulate practices that degrade the natural resources underpinning agriculture, notably soils and water; which encourage overuse of agro-chemicals such as synthetic fertilisers and pesticides; and subsidies that reduce biodiversity-especially the natural enemies of insect pests and weeds-and the genetic variability that enhances crop productivity and resists new diseases, are examples of perverse subsidies (Gulati, 1989). India's farm subsidies harm its own economy. Farmers are incentivized to devote more land and water to subsidized crops (wheat,

rice, etc.) desired by the government. This leads to less production and higher prices for other items (fruits, vegetables, etc.) that consumers also want to buy. India justifies these policies under the guise of achieving “food security” by encouraging domestic production of basic crops (Pearson, 2014). The outcome of these policies is that the government of India increases its expenditure in order to keep nominal prices of the subsidized input unchanged because of the political pressure applied by the farmers, which accounts for about half of India's population (Anonymous, 2009). The subsidy system is also causing the misallocation of resources, which may reduce India's ability to meet its future food demand. Current growth in food demand is predominantly for vegetable and meat products, associated with the changing consumption patterns of the growing middle class. Demand for grain products is declining. The current policy regime is not suited to this change and is incapable of adapting. Although there is now a surplus of these wheat and rice crops, farmers have no incentive to diversify so long as the purchase of these crops is guaranteed. Policy changes would be extremely unpopular among farmers, who rely on the subsidies as a form of income support (Jones, 2013). It is therefore necessary that any policy change is carefully designed, so as to encourage innovation in a way that farmers perceive will benefit them. Removal of the subsidies without compensation would harm household food security. To achieve subsidy reform without provoking unrest, will require changes that involve multiple policy mechanisms, including extension, education and incentives. This study has tried to highlight the perception of the stakeholders regarding the impact of agricultural subsidies in Punjab which would help the policy makers to make new policies or reform the existing ones to enhance India's food security, welfare and, in the long-term, and economic growth.

## **METHODOLOGY**

### **Study Area**

The survey was conducted in three districts viz. Amritsar, Bathinda and Hoshiarpur of the three selected agro-climatic zones of Punjab viz. Central Plain Zone, Western Zone and Sub-Mountain Undulating Zone respectively. The three districts were selected on the basis that all the three districts had common agricultural schemes which provide subsidies on different inputs to the farmers. The selected agricultural schemes under which subsidies were provided to the farmers in Punjab are Rashtriya Krishi Vikas Yojana (RKVY), National Food Security Mission-Pulses (NFSM-Pulses), National Horticulture Mission (NHM), National Mission on Oilseeds and Oil Palm (NMOOP) and National Mission on Agricultural Extension and Technology (NMAET).

### **Data Collection**

The research was carried out in March 2016 after a pre-test conducted in January 2016. The study comprised of 220 respondents which included 90 beneficiary and 90

non-beneficiary farmers of the subsidy scheme, 20 economists from Punjab Agricultural University, Ludhiana and 20 extension personnel who are directly involved in the disbursement of the subsidies under various agricultural schemes were selected from the three districts of Punjab. A multistage sampling was followed to select the farmers. The beneficiary farmers comprised of those farmers who were availing subsidies under the various agricultural schemes such as RKVY, NFSM-Pulses, NHM, NMOOP and NMAET along with the general subsidies such as electricity, fertilisers and credit which are available to all farmers. While the non-beneficiary farmers were those farmers who have not availed any subsidy under the schemes mentioned earlier but were having general subsidies. From amongst the various subsidies given to farmer, the power, fertiliser and credit subsidies were placed under the category of general subsidies as they were available to every farmer and were not given under any agricultural schemes while the subsidies on seeds, plant protection materials, machinery and micro-irrigation units were placed under the category subsidies provided under schemes. An interview schedule was administered to all the stakeholders to study the perceived impact of the agricultural subsidies in Punjab. The interviews had closed questions and some questions also elicited quantitative data.

### **Data Analysis**

All data were analysed with the use of appropriate statistical tools. Descriptive statistics was applied to analyse percentage, mean and standard deviation. To test the differences in the perception of stakeholders, chi-square statistics were conducted. A significance of  $p < 0.01$  was set for statistical significance.

## **RESULTS AND DISCUSSION**

### **Perception of the Stakeholders on Impact of General Agricultural Subsidies in Punjab**

The perusal of data in Table 1 revealed that there was a significant difference in the perception of the impact of power subsidy on the increase of rice area in Punjab. Only 17.22 per cent of the farmers perceived that the power subsidy was responsible for the increase of rice area in Punjab while 72.78 per cent of them perceived that there was no impact of power subsidy in the increase of rice area. While discussing, the farmers mentioned that the increase of rice area in Punjab was due to several reasons such as assured procurement price and minimum support price, unmatched yield in respect to other crops such as maize and cotton. Cotton as a crop was failing in Punjab due to the constant attack of insect-pests forcing farmers to shift towards the rice cultivation. Even the pulses which are sometimes, grown as a rotation crop which is easily susceptible to diseases once the weather is conducive for the micro-organisms. Same instances were reported for maize crop also where the yield of the crop decreases because of diseases in warm humid weather for which the farmer has to suffer losses. Besides, all these crops other than wheat and rice had no assured marketing in Punjab.

**Table 1: Distribution of stakeholders according to their perception on impact of general agricultural subsidies (Per cent)**

Impact		Yes	No	CS	$\chi^2$ - value
<b>Power Subsidy</b>					
Increase in the rice area in Punjab.	F (180)	17.22	72.78	10	30.23**
	E (20)	60	40	--	
	Ext (20)	55	45	--	
Over-exploitation of groundwater in Punjab.	F (180)	90.55	--	9.44	4.09 <sup>NS</sup>
	E (20)	100	--	--	
	Ext (20)	100	--	--	
Interrupted and irregular supply of subsidized electricity increases the maintenance cost of pump sets thus increasing the overall cost of production.	F (180)	76.11	--	23.89	11.88 <sup>NS</sup>
	E (20)	100	--	--	
	Ext (20)	100	--	--	
Fiscal burden on government	F (180)	88.33	--	11.67	37.11**
	E (20)	85	15	--	
	Ext (20)	80	20	--	
<b>Fertiliser Subsidy</b>					
Subsidies on urea allow its overuse amongst the farmers.	F (180)	15	63.89	21.11	59.07**
	E (20)	80	20	--	
	Ext (20)	75	25	--	
Higher price of non-urea fertilisers.	F (180)	--	88.89	11.11	1.47 <sup>NS</sup>
	E (20)	--	85	15	
	Ext (20)	--	80	20	
<b>Credit subsidy</b>					
Reduced dependency on money lenders for credit	F (180)	12.78	69.44	17.78	2.47 <sup>NS</sup>
	E (20)	20	60	20	
	Ext (20)	20	55	25	
Formal subsidized agricultural credit on low interest rate is easily accessible to farmers.	F (180)	17.22	72.78	110	1.06 <sup>NS</sup>
	E (20)	15	70	15	
	Ext (20)	20	65	15	

\*\*Significant at 0.01 level, CS = Can't Say, F=Farmers, E=Economists, Ext=Extension Personnel, NS = Non-significant at 0.01 level, Figure in the brackets represent the number of the respondents

Thus, no alternate crop is profitable enough to replace rice at many levels thus increasing the rice area in Punjab. Less than two-third of the economists and 55 per cent of the extension personnel perceived that power subsidy was one of the strong reasons for the increase of rice area in Punjab. Alike both the categories of farmers, the economists and extension personnel also acknowledged that announcement of MSP and assured procurement of wheat-rice affects the decision of the farmers to cultivate wheat and rice. They also mentioned that the yield of wheat and rice is far greater than the yield of the other crops such as cotton, maize and sugarcane which is compelling the growers of these crops to shift towards rice cultivation. It is evident from the fact that Punjab contributes 43 per cent of wheat and 21 per cent of rice in the central pool (Anonymous, 2015a).

About 90.55 per cent of the farmers perceived that the power subsidy had led to over exploitation of groundwater in Punjab. The farmers mentioned that there was an uninterrupted and untimely supply of electricity and the farmers had to keep their pumps switched on all

the time so that whenever power was supplied, the motors would pump the water and most of the times there is no one to check on it. They also mentioned that the increase in rice cultivation by the Punjab farmers was also a major contribution in the over-exploitation of the groundwater. All the economists and extension personnel perceived that over-exploitation of groundwater was the result of power subsidy being provided to the farmers. They mentioned that the free electricity has acted as bait for the farmers to shift to rice cultivation which has ultimately led to the crisis of the groundwater depletion in the Punjab state. They also mentioned that the number of electric and diesel operated pumps have increased with the advent of the power subsidy (Sarkar & Das, 2014). The situation at present is such that the depleting ground water crisis has compelled the farmers to use heavy pumps to draw out more water which further increases more of electricity consumption.

On the other hand, in the absence of supply of good quality electricity, the farmers use diesel operated pumps in order to pump out the water. So irrespective of the

presence of free power subsidy, the farmers are forced to use diesel operated pumps which further increases their cost of cultivation. The economists mentioned that low agricultural revenues have led the state authorities to view agriculturalists as a liability. As a result of which this, the state is providing low quality electricity to the farmers under the de facto “de-electrification” agenda (Gulati & Pahuja, 2015). This low quality electricity has led to the frequent burnouts of motor pumps and the farmers suffer the increased cost of maintenance.

Another economic impact of the power subsidy as reported by 76.11 per cent of the farmers was that the interrupted and irregular supply of subsidized electricity led to motor burnouts which increased the maintenance cost of motor/pump sets thus increasing the overall cost of production. The farmers mentioned that these frequent burnouts have a heavy toll on their pockets. Regarding the increased cost of maintenance of motor pumps due to frequent burnouts because of the interrupted and untimely supply of subsidized electricity, all of the economists and extension personnel perceived that it was the result of the faulty power subsidy. The findings were in line with the findings of Sarkar and Das, (2014) and Kaur and Sharma, (2012).

The free supply of electricity has increased the fiscal burden on the government was perceived by 88.33 per cent of the farmers. Majority of the economists (85 per cent) and all of the extension personnel perceived that there provision of power as a subsidy to the farmers increases the fiscal burden on the government. They mentioned that it is not possible to supply something free without suffering the consequences for it. Both the stakeholders mentioned that it was better to remove the power subsidy and provide farmers with a good and timely supply of electricity and use the revenues and funds for increasing infrastructure for the development of the agriculture sector and uplift the condition of the farmers. A difference in the perception was also noticed between the farmers and the other two stakeholders. The difference was noticed because a section of farmers believed that it was the duty of the government to provide subsidies on power to farmers and the subsidies then should not be considered as a fiscal burden on the government.

Farmers (63.89 per cent) perceived that the fertiliser subsidy had no impact on the overuse of the urea. Whereas 21.11 per cent of them could not perceive any impact, 15 per cent of the farmers perceived that the fertiliser subsidy on urea was the reason of its overuse because it was available at a cheaper subsidized rate. The farmers perceived that it was not the fertiliser subsidy but the lack of knowledge and awareness about the dosage of usage that allows its overuse. They also mentioned that especially urea acted as a fertiliser whose application gives quickly and observable results in the fields. The crop will show maximum vegetative growth and look all green which is preferred by majority of the farmers. The

implications of the overuse of the urea led to the loss of soil fertility. Majority of the economists (75 per cent) and extension personnel (70 per cent) perceived that the fertiliser subsidy on urea was responsible for its overuse by the farmers. They reported that the farmers may be somewhat unaware about use of right dosage of urea in crops; the cheaper rate of urea was also one of the major reasons for its overuse as it was readily available to the farmers. Regarding the higher price of non-urea fertilisers, 88.89 per cent of the farmers perceived that it was not an impact of the fertiliser subsidy. It was interesting to find out that maximum of farmers knew that the non-urea fertilisers were decontrolled fertilisers but knew nothing about the NBS regime. On asked whether the decontrol of urea subsidy will force farmers to use less of urea as it will be now available at costlier rate than before, it was found that the farmers replied in another context. They mentioned that any sudden rise in the prices of urea would face major unrest from the farming community. They also highlighted that the urea was still one of the cheap inputs available in the rising cost of the inputs required for farming. The economists and the extension personnel also perceived that the fertiliser subsidy had no impact on the higher price of the non-urea fertiliser as these fertilisers were under the NBS scheme and that it had no role whatsoever in hindering the farmer to diversify to other crops which may be requiring more application of the non-urea fertilisers. The difference in the perception of farmers and the other two stakeholders is clearly evident from the analysis of the data in Table 1 which shows a significant difference.

The data also showed that 69.44 per cent of farmers perceived that credit subsidy had no impact on reducing the dependency on money lenders for credit while more than two-third of farmers (72.78 per cent) perceived that the formal subsidized agricultural credit at low interest rates was not easily available to farmers. Still the money lenders are the most used source of credit especially for small and marginal farmers. The farmers mentioned that it was difficult to avail formal subsidized because of lack of bank accounts and awareness on different credit system available for farmers and complex process of commercial banks providing agricultural credit which was least understood by small scale farmers. Lack of collateral also prevents farmers especially the small and marginal farmers to access credit. The banks attitude of risk aversion also prevents the farmers to access credit because the banks are hesitant to give loans to agriculture sector as higher risks are involved in terms of crop failures which leads to increase in the number of defaulters. It was observed that 60 per cent of the economists and 45 per cent of the extension personnel perceived that credit subsidy had no impact in reducing the farmers' dependency on money lenders for credit. More than two-third of the economists (70 per cent) and a little less than two-third of extension personnel (65 per cent) perceived that the formal credit was not easily accessible to the

farmers. The reasoning mentioned by the economists and extension personnel was in line with that of the farmers. The findings were in line with the findings of Narayanan, (2015), Sarangi, (2010) and Anonymous, (2011).

#### **Perception of the Stakeholders on the Impact of Agricultural Input Subsidies Available under Agricultural Schemes in Punjab**

The data presented in Table 2 revealed that 84.44 per cent of the beneficiary and 80 per cent of the non-beneficiary farmers perceived that providing seed subsidies on the seeds of non-traditional crops would not encourage farmers to diversify to plantations, orchards, vegetable cultivation etc. The reason given by them in this regard was that the subsidy on seeds is welcomed by the farmers but more than the subsidies, availability of the markets for these non-traditional crops is required. They mentioned that the extension personnel, scientists or the government ask the farmers to diversify, but they do so without creating the necessary market for those crops. Assured procurement and maximum yield from these non-traditional crops which can match the wheat-rice will pave way for the farmers to diversify. Some of the farmers also mentioned that seeds and inputs for crops other than rice and wheat are given in very less quantity under subsidy which also discourages diversification.

The data also revealed that majority of the economists (85 per cent) and extension personnel (90 per cent) perceived that there was no impact of the subsidies provided on seeds of non-traditional crops which would lead to diversification to plantations, orchards and vegetable cultivation as perceived by the farmers also. The economists in this context also mentioned that the cultivation of the non-traditional crops should be increased which would help in establishing the markets required for these crops.

Majority of the beneficiary (75.55 per cent) and non-beneficiary (73.33 per cent) farmers perceived that unabated use of the pesticides and insecticides by the farmers were the result of the faulty and sub-standard material given under subsidies. The farmers mentioned that sub-standard quality of the chemicals available at cheaper rates compel them to use more and more of these chemicals to get desired results against the insect-pest control in their crops. As mentioned earlier also, both the categories of farmers have demanded for the removal of plant protection subsidy and improvement in the quality of pesticides and insecticides. The findings were in line with the reports of Anonymous, (2015b). Alike both the categories of farmers, majority of the economists (75 per cent) and extension personnel (85 per cent) perceived that the supply of sub-standard quality of plant protection material under the subsidies were responsible for the unabated use of the pesticides by the farmers. They also revealed that farmers preferred to use more of these chemicals as they think that this would keep their crop safe from any pest or disease attack.

Majority of the beneficiary (81.11 per cent) and non-

beneficiary (88.89 per cent) farmers perceived that the under use of the agricultural machinery on small holdings results in indebtedness of the small and marginal farmers. As it has been reported that more than 85 per cent of farmers in India belong to the category of small and marginal farmers and most of the small and medium-sized machines available in the market are often of poor quality and lack adequate safety measures. Most of the time, besides the farming season these machines are kept unused which increases their maintenance which are to be borne by the farmers. Majority of economists (85 per cent) and extension personnel (70 per cent) perceived that there was indebtedness among the farmers especially small and marginal farmers due to under use of machinery on small holdings. They mentioned that large and medium farmers' fondness of bigger machinery has led to its over-mechanization in many cases with farmers acquiring tractors of far higher horsepower than required according to their farm size. Though tractors are also used for purposes other than farm work, such as for haulage of farm inputs and produce and as personal transport, they remain idle for most part of the year. Investment in such machines is, therefore, not advised. However, this preference for bigger machines persists because they become status symbols in rural areas just as large cars have in urban belts.

Regarding the micro-irrigation subsidy, a little less than two-third of beneficiary (62.22 per cent) and more than 50 per cent of the non-beneficiary (54.44 per cent) farmers perceived that the subsidies provided on drip irrigation and sprinkler system in Punjab would not help a lot in reducing the groundwater depletion. The reasons they mentioned was that the presence of a dominating wheat-rice cropping system will allow a less use of these micro-irrigation units because these crops require the flooding system of irrigation. On the other hand during the interaction with the farmers, some of them mentioned that farmers were using these units for crops like potato, pulses, pea and fruit crops. They also mentioned that lack of awareness and complexity in the use of drip irrigation system hinders the farmers to adopt these techniques. Irrespective of the use of these techniques, it was observed that the power subsidy created a carefree attitude of farmers towards the depleting ground water problem. Some of the farmers were found to be flooding their orchards instead of using a ring-basin or drip-irrigation method which would still allow a lesser wastage of water. Similar to farmers, majority of economists (75 per cent) and extension personnel (85 per cent) also perceived that there was no impact of subsidies being provided on sprinkler and drip irrigation in reducing the crisis of groundwater depletion in Punjab as the major cropping system in Punjab is dominated by the rice-wheat system.

#### **CONCLUSION AND SUGGESTIONS**

Difference of perception was noticed between the farmers and other two stakeholders regarding the increase

**Table 2: Distribution of stakeholders according to their perception on impact of agricultural subsidies provided under agricultural schemes**

Impact		(Per cent)			$\chi^2$ - value
		Yes	No	CS	
<b>Seed Subsidy</b>					
Subsidies on seeds of non-traditional crops increases diversification towards plantations, orchards, vegetables etc.	BF (90)	--	84.44	15.56	1.47 <sup>NS</sup>
	NBF (90)	--	80	20	
	E (20)	--	85	15	
	Ext (20)	--	90	10	
<b>Plant protection subsidy</b>					
Unabated use of pesticides and insecticides by the farmers.	BF (90)	75.55	8.89	15.56	8.99 <sup>NS</sup>
	NBF (90)	73.33	7.78	18.89	
	E (20)	90	10	--	
	Ext (20)	85	15	--	
<b>Machinery subsidy</b>					
Indebtedness among small and marginal farmers due its low use on small holdings.	BF (90)	81.11	--	18.89	2.43 <sup>NS</sup>
	NBF (90)	88.89	--	11.11	
	E (20)	85	--	15	
	Ext (20)	80	--	20	
<b>Micro-Irrigation subsidy</b>					
Subsidies on sprinkler system and drip irrigation in Punjab helps in reducing ground water depletion	BF (90)	23.33	62.22	14.44	13.96 <sup>NS</sup>
	NBF (90)	21.11	54.44	24.44	
	E (20)	--	75	25	
	Ext (20)	--	80	20	

BF=Beneficiary farmers, NBF=Non-Beneficiary farmers, E=Economists, Ext=Extension Personnel, CS=Can't Say, NS = Non-significant at 0.01 level, Figure in the brackets represent the number of the respondents

of rice area in Punjab as an impact of the power subsidy and the overuse of urea by the farmers as an impact of fertiliser subsidy. This study concluded that the perception of the stakeholders didn't vary much regarding the impact of agricultural subsidies. Further, it revealed that the framework of these subsidies has led to an unabated use of inputs by the farmers and also an unequal distribution of these inputs among the farmers i.e. they are not well targeted. The subsidies are creating more disparity between the large and small farmers. On the other hand, the environmental implications of these subsidies are also alarming. The agriculture majorly depends on the judicious use of the natural resources. But with time overexploitation of these resources are causing stagnation in the overall production. Looking at the research findings, it can be suggested that electricity tariffs should be imposed on the large farmers who have the capacity to pay the bills while only small and marginal farmers should be given the benefit of power subsidy. This would help in reducing over-exploitation of ground water and fiscal burden on the government. Also, allocation of subsidized urea needs to be done in proportion to the operational land holdings of the farmers to avoid its overuse. Amount of subsidies pertaining to crops other than wheat and rice needs to be increased to promote diversification in Punjab towards high value crops such as vegetables, fruits etc. where techniques like

drip and sprinkler irrigation can be efficiently used. This would help in reducing the ground water depletion. Agricultural subsidies on various inputs can be discontinued in a phased manner once they become cost-effective to avoid fiscal burden on government and shifted towards required areas in agriculture.

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## Role of Affiliate Marketing in Today's Era: A Review

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### ABSTRACT

Affiliate marketing is a type of performance-based internet marketing in which a business rewards one or more affiliates for each visitor or customer brought by the affiliate's own marketing efforts. Affiliate marketing is one of the oldest forms of marketing wherein you refer someone to any online product and when that person buys the product based on your recommendation, you receive a commission. The most common question I hear, companies asking themselves that "Half the money I spend on advertising is wasted; the trouble is I don't know which half". The simple answer is Affiliate marketing through which you can track the amount being spent on affiliates and performance of affiliates can be tracked through maintaining record of who is sending the traffic and getting the sales. Through this paper we tried to understand the concept, knowledge and scope of affiliate marketing.

### Keywords

Affiliate marketing, content providers, online marketing

### JEL Codes

L81, M31, M37

### INTRODUCTION

Who had ever thought that with just a couple clicks you could be connected to the whole world? The internet made this possible. When the internet came around, it was a totally new concept. It was end of 1960, when the World Wide Web (WWW- a new media for publishing information) introduced and it started its rapid growth (Chaffey, 2003). Soon after the release of internet, companies realised the marketing possibilities and opportunities that internet bring through but from merchant's point of view, internet brings threats also. One such example of change was introduction of new and diverse intermediaries in the existing value chain (Sarkar *et al.*, 1995). It became imperative for firms to adjust their business models to with the upcoming new changes/trends for survival in the competitive world.

#### Emergence of Cybermediaries and Content Providers

With introduction of new intermediaries and rapid development of internet, existing traditional intermediaries (such as retailers and wholesalers) in the value chain between manufacturers and end customers started eliminating (Hoffman *et al.*, 1995). This process of emergence of new intermediaries is called cybermediation-emergence of new types of intermediaries that are operating at electronic markets

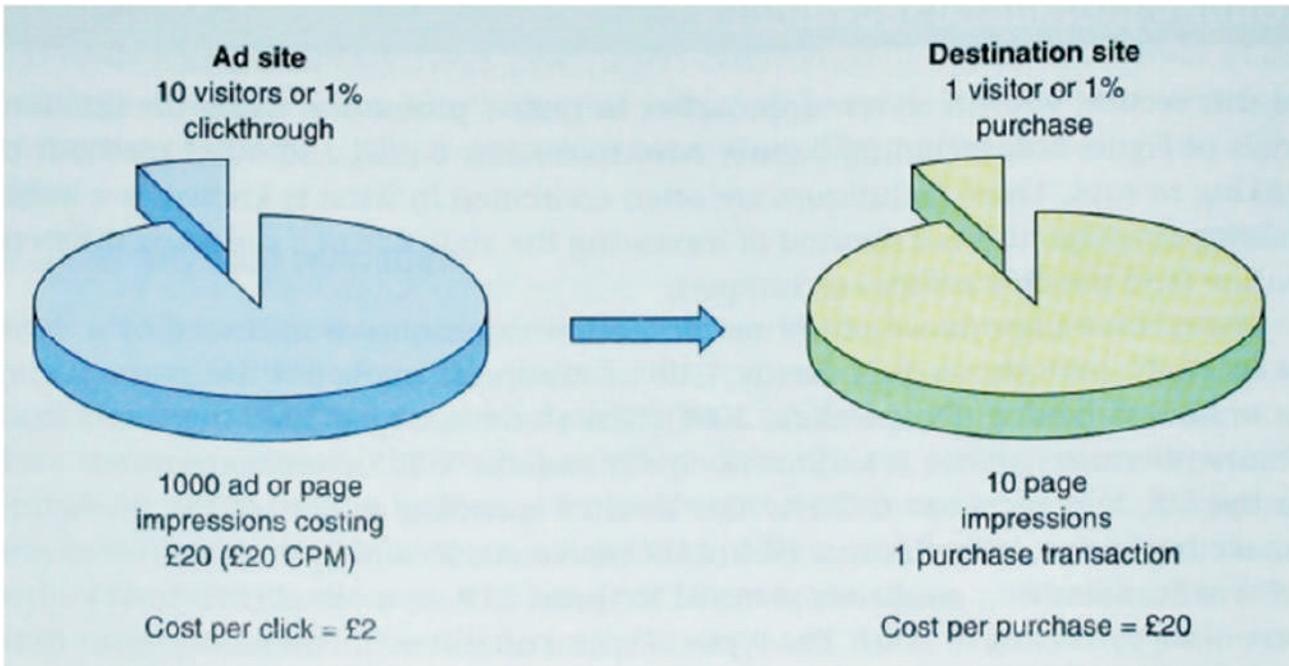
(Sarkar *et al.*, 1995). These new intermediaries-cybermediaries sometimes also called infomediaries (Jacobs, 2002). Cybermediary works as "an online organization that aggregates and distributes information" and online cybermediaries act as the middleman between the buyer and seller (Strauss *et al.*, 2006). Cybermediaries are referred as content providers that offers online advertising to merchants and they are defined as people or companies that "distribute copyright content via the internet" such as owners of websites, bloggers etc. (Eisenmann & Brown, 2000).

#### Online Advertising

Online advertising also called internet advertising, is the convergence of traditional advertising and direct response marketing (Zeff and Aronsonman, 1999). Online advertising frequently involves both a publisher, who integrates advertisements into its online content, and an advertiser, who provides the advertisements to be shown or displayed on the publisher's content (Chaffey, 2003).

#### Model of Online Advertising

In the following example, Ad site displays thousand times an ad, on which 10 visitors click (hence 1 per cent click through) and those visitors are taken to the destination site, where 1 of them actually purchases the advertised goods. In this case, spending of £20 on



displaying the ad resulted in one sale, thus the advertising cost per purchase was £20 (Chaffey, 2003). With time share of advertising expenditures allocated in the online advertising was increasing, therefore companies started to examine, how many visitors, attracted by the ads on other websites, are finally turned into customers. After counting all costs, the amount needed to acquire one customer was in many cases even higher than his/her average lifetime value. Therefore it was necessary to adopt more efficient forms of customer acquisition as the present situation was not sustainable in the long-run. Based on this needs, the concept of affiliate marketing arose (Hoffman and Novak, 2000).

#### AFFILIATE MARKETING

Affiliate Marketing is also known as a Performance Oriented Internet Marketing, Partner Marketing, CPA(Cost Per Action), Associate Program, or Pay-For-Performance Program (Benediktova & Nevsad, 2008). Affiliate marketing is a type of online advertising, where merchants share percentage of sales revenue generated by each customer, who arrived to the company's website via a content provider. Affiliate Marketing Industry has four core players: the merchant (also known as 'retailer' or 'brand'), the network (that contains offers for the affiliate to choose from and also takes care of the payments), the publisher (also known as 'the affiliate'), and the customer. Content provider, also referred to as affiliate, usually places an online ad at its website. When visitors click at the ad, they are redirected to merchant's website and affiliation is tracked by a cookie stored on visitors' computers (Gallaughner *et al.*, 2001). Merchants, within online marketing called advertisers, pay for the content providers' services only when a visitor coming from content provider's website executes a specified action.

Such action can be a purchase of a product, filling in a form with personal data, etc. (Gallaughner *et al.*, 2001). Affiliates take the whole risk connected with marketing merchant's products. If affiliate's marketing efforts work, affiliate makes money and if they don't, affiliate does not make money and pays opportunity costs. There are no limits for an affiliate how much money it can earn or spend (Duffy, 2005).

#### Benefits of Affiliate Marketing to Merchants

Merchants can display ads for its products on thousands of independent websites and pay to content providers only when the ad would actually lead to a sale. In such scenario, advertising cost was no more fixed cost but was shifted to variable cost (Hoffman and Novak, 2000). Apart from increasing the sales, affiliate marketing is also beneficial for enhancing the reach and creating broader exposure (Chatterjee, 2002). Recommendation of a product or service on a partner website can create halo effect and thus encourage the customers to purchase (Gallaughner *et al.*, 2001). Moreover, with the help of affiliate marketing, companies can gain those customers too that are usually very difficult to reach and at the same time save on online campaigns planning (Hoffman and Novak, 2000).

#### Benefits of Affiliate Marketing to Content Providers

Affiliate marketing gives content providers new opportunities for generating revenues from their websites. Provides content providers with the opportunity to cooperate with large number of merchants, to which they would not have access otherwise (Duffy, 2005). Content providers have to choose affiliate programs very carefully, because of the opportunity cost connected with not employing competing programs and therefore, they target the advertising even more precisely

than merchants themselves, as otherwise they would not get optimal income (Hoffman and Novak, 2000).

### COMPENSATION MODELS IN AFFILIATE MARKETING

Advertisers can choose following compensation models in order to pay commissions to the content providers:

- a. Pay per sale (PPS): Commission is paid for each sale made by a visitor from the affiliate website.
- b. Pay per lead (PPL): The affiliate is paid after a website visitor carries out a specified action such as subscribes to a newsletter, fills in a questionnaire etc. Pay per lead is also known as pay per action (PPA).
- c. Pay per click (PPC): Content providers receive commission for every click at the link to advertiser's website.

The commission, which merchants pay to affiliates, can be either set as a flat fee (the affiliate will get the same amount of money for each sale) or as a percentage of the sale value (Hoffman and Novak, 2000).

#### Example: Amazon Associates

Earth's biggest selection online store: Amazon. Amazon is an international e-commerce company offering online retail, computing services, consumer electronics, digital content as well as other local services such as daily deals and groceries. Amazon is the leading e-retailer with net sales worth more than 107 billion U.S. dollars in 2015. As of the fourth quarter of 2015, the e-retailer reported more than 304 million active customer accounts worldwide. Due to Amazon's global scope and reach, it is also considered one of the most valuable brands worldwide. The Amazon Associates Program is one of the largest and most successful online affiliate programs, containing products from over 1.6 million vendors (i.e. anyone selling products on their site), as well as thousands and thousands of affiliates. Amazon's affiliate program mechanism is users friendly and easy to grasp, which makes it ideal for non-tech business minded people who are looking to earn money on the internet.

### COMMISSION RATES FOR AMAZON AFFILIATES (CONTENT PROVIDERS)

Product category wise approximate commission rates offered are as follows:

- Up to 8.5 per cent on Home, Kitchen, Garden and Grocery.
- Up to 6 per cent on Gift Cards.
- Up to 5 per cent on Digital Entertainment, Up to 8.5 per cent on Kindle Books.
- Up to 8.5 per cent on Sports, Outdoors and Hobbies.
- Up to 5 per cent on Music and Movies.
- Up to 4 per cent on Electronics, Wireless and Computers, Up to 10 per cent on Gaming.
- Up to 8.5 per cent on Tools, Home Improvement, Auto, Amazon Supply and Industrial.
- Up to 8.5 per cent on Kids, Baby and Toys.
- Up to 8.5 per cent on Health and Beauty.

- Up to 8.5 per cent on Fashion, Shoes and Jewellery.
- Up to 8.5 per cent on Books and Magazines.  
(Source: affiliate-program.amazon.com)

### AFFILIATE PROGRAM IN INDIA

India is one of the largest marketing hubs in the world and has an outstanding potential for innovative business. Affiliate marketing is widening its scope in India with some great demand by several western companies. Today affiliate program is one of the best sources to generate profits online. There are very few Indian based affiliate companies that are successful to make their mark and liked by a majority of Indian webmasters.

#### Best Affiliate Marketing Companies and Firms in India- January 2017

Affiliate marketing companies provide businesses which produce products and services with a unique opportunity to reach new audiences through a variety of publishers.

- (a) SEOValley Solutions Private Limited
- (b) BruceClay
- (c) VJG Interactive
- (d) Boostability
- (e) BrainPulse Technologies
- (f) Palcom Web Pvt. Ltd.
- (g) eAffiliatez.com
- (h) WGM Media Services Pvt Ltd.
- (i) Thinktank Infotech Pvt. Ltd.
- (j) VC Internet Media Pvt. Ltd.

(Source: www.topseos.com)

#### Top Online Shopping Affiliate Programs in India

1. Flipkart.com: Earn commissions by placing banners or links on your website to refer users to the Flipkart.com website. Affiliate can earn up to 15 per cent every time a user clicks on the banner/link and makes a purchase on flipkart site.
2. SnapDeal.com: For a successful sale, if someone clicks on this promoted link and buys any product on website, affiliate is eligible for getting 10 per cent of sale amount to a maximum of rupee 400.
3. Infibeam.com: Affiliate can earn up to 10 per cent commission for any sales that they generate for infibeam. Affiliates get to choose from a huge selection of product categories.
4. Shimplify.com: Affiliate can earn commissions up to 6 per cent on each sale by placing banners, or links on their website. It has one of the largest catalog in India with over 1.7 crore products.
5. GoDaddy.com: Just place one of their banners or links where visitors, customers and friends will see it and affiliates will earn cash on every qualifying sale made through affiliates' ads.

#### Top Matrimonial Affiliate Programs in India

1. Shaadi.com: Earn 75 per cent revenue share plus an additional 25 per cent bonus opportunity for a total of up to 100 per cent commission with the world's largest matrimonial site.

2. BharatMatrimony.com: affiliate has to place banner in his/her webpage and he/she will get paid for every paid membership that's generated through his/her site.
3. JeevanSathi.com: affiliate has to provide a links on his/her website that fetches free and paid registration to JeevanSathi.com and affiliate will be entitled to a commission.

#### Top Tour and Travel Affiliate Program in India

1. MakeMyTrip.com: is considered a number one website in tour and travel information, booking and as a travel agent site with competitive rates.
2. TripAdvisor.com: enables affiliates to partner and earn up to 50 per cent commission with the world's largest and most trusted travel community.
3. Yatra.com: is for publishers who want to leverage their web properties with easy implementation that allows affiliates to start earning commissions within a few minutes of acceptance.

#### CONCLUSIONS

Commission is the main reason why people engage in affiliate program. Today, almost every top Indian e-commerce store has an affiliate program. In India this paradigm shift happened in the last 3-4 years, when advertisers started testing this channel and discovered that affiliates provide near about twice the returns in comparison to other digital marketing campaigns. Approximately 40 per cent of marketing professionals quote affiliate marketing as the most desired digital skill. Approximately 15 per cent of all digital media industry's revenue comes from affiliate marketing.

#### SCOPE OF THE STUDY

Affiliate marketing industry to grow to \$6.8 billion over next five years. To know perception and effectiveness of affiliate marketing programs, a survey named "Affiliate network" was conducted in New York by mThink on February 4, 2016. Among the results, nearly 90 per cent of advertisers said that affiliate programs were very important to their marketing strategy, and the majority of publishers revealed that affiliate partnerships drove more than 20 per cent of annual revenue. Affiliate marketing is now viewed as a powerful channel for creating consumer that leads to brand engagement and incremental sales at compelling ROIs (Return on Investments). More than 80 per cent of advertisers

devoted over 10 per cent of their marketing budget to affiliate marketing.

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## Impact of Women Dairy Co-Operative Societies on Marketed Surplus of Milk in Bihar

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### ABSTRACT

The study has analysed the impact of membership of women in dairy co-operative society on the marketed surplus of milk. The study has been conducted in Begusarai district of Bihar by collecting data from 80 member and 80 non-member milk producing households which were stratified into small (<4), medium (5-6) and large (>6) herd size categories. Marketed surplus has a direct relationship with income earned by the household. So it is important to raise the marketed surplus in order to achieve the target of doubling farmers' income by 2022. A higher marketed surplus indicates higher income for the household. The study concluded that the marketed surplus of milk for member households was more than non-member households. Other factors, besides, membership in women dairy co-operative society, which had a positive and significant influence on marketed surplus of milk were price of milk and herd size. Thus, the study has concluded that Women Dairy Co-operatives are instrumental in improving marketed surplus thereby, enhancing the income of the households.

### Keywords

Marketed surplus, women dairy co-operative societies

### JEL Codes

D1, E2, Q13, Q18, Q19

### INTRODUCTION

India is the largest milk producing country in the world with a production of 146.3 million tonnes during the year 2014-15 and having a share of about 18 per cent of world milk production. Consequently, the per capita availability of milk has increased from 112 g per day in 1970-71 to 322 g per day in 2014-15. It is estimated that about 70 per cent of the total milk is produced by landless labourers, marginal and small farmers located in widely dispersed rural areas. Milk being a highly perishable product has to be disposed off and/or has to be converted into different products as early as possible. The milk and milk products are the important food items for human health and nutrition in India. Therefore, milk producers boil the retained milk and some part is converted into a variety of traditional milk products like ghee, Khoa and curd, etc. Rest of milk is sold to organized sector (milk producer's co-operative societies) and unorganized sector (milk vendors, contractors, tea shops, Halwais). But the production and quick disposal of milk depends on the marketing facilities available in the area whether markets

are efficient or not, providing remunerative price to the producers or not and most important if products are available at reasonable price to the consumers or not. Around 12-15 per cent of total milk produced in the country is handled by the organized sector and rest of milk by un-organized sector. The total production of milk in a household depends upon the proportion of animals in milk in addition to types of milch animals.

Marketed Surplus is that part of production which is actually brought to the market for sale. A number of factors influence marketed surplus in a milk producing household like milk production level, price of milk, family size, education score, herd size, operational holding, membership etc. For greater availability of milk to consumers, it is necessary that marketed surplus should increase out of increased production. Now-a-days there is a lot of talk about doubling farmers' income by 2022. If a farmer has to increase his income, there is a need to have an increase in the quantity of produce that he sells in the market i.e., marketed surplus. Thus, an increased marketed surplus means an increase in income of the

households.

A precise idea about the production, marketed surplus and consumption of milk is also important for planning and policy purposes with a view to generate economic information's useful for projecting development activities in the dairy sector. Many studies have been carried out in this regard by Chauhan & Sharma (1990), Siwach & Dhaka (1993), Saha (1998), Aggrawal *et. al.* (2009) and many others. Keeping above facts in view, the present study has been undertaken in Begusarai district of Bihar with the following objectives (i) to ascertain marketed surplus of milk (ii) to examine consumption and production of milk and (iii) to study the factors affecting marketed surplus in the study area.

#### DATA AND METHODOLOGY

The multistage sampling procedure was adapted for selection of state, milk union, district, block and villages. The state of Bihar was purposively selected as the state ranks ninth in the country in terms of milk production. In 2014-15, the milk production in the state was 7.77 million tonnes, which was 5.3 per cent of the national milk production (NDDB, 2016). Further, Deshratna Rajendra Prasad (D.R.) Milk Union, Barauni, was purposively selected from the six milk unions in Bihar Co-operative Milk Producers' Federation Ltd. (COMFED) as it had the highest milk procurement per day. From the 4 districts covered by the D.R. Milk Union, Begusarai was purposively selected as it had the highest number of Women Dairy Co-operative Societies (WDCS). In Begusarai district, 4 blocks, namely, Cheria Bariyarpur, Bachhwara, Bhagwanpur and Teghra were purposively selected based on number of WDCS and from each block, two villages were randomly selected.

After complete enumeration of 8 selected villages with respect to milch animals, the households were categorized into small, medium and large herd-size holders using cumulative square root frequency method of stratification. From these 8 villages, a sample of 80 member households and 80 non-member households were randomly selected according to probability proportional to size. The number of small, medium and large herd category households selected was 50, 19 and 11, respectively for member group and 47, 20 and 13, respectively for non-members. Data were collected for two seasons, viz. summer and winter from these two groups using a semi-structured interview schedule. Multiple regression analysis was used to determine the impact of membership of co-operatives on the marketed surplus of milk.

Marketed surplus is that quantity of produce which the producer farmer actually sells in the market, irrespective of his requirements for family consumption, farm needs and other payments.

The total milk production of the household is the total milk produced by all the milch animals of the households. The quantity of milk retained at home for consumption or conversion into milk products was taken as the per day

milk consumption of household.

**Marketed Surplus of Milk = Total Milk Production - Total Milk Consumption**

#### Factors Determining Marketed Surplus

- i. **Herd Size:** Herd size is directly linked to the amount of milk production. It is hypothesized that the amount of marketed surplus is directly proportional to the herd size.
- ii. **Family Size:** The consumption of milk depends upon the size and composition of family. This is reflected in the marketed surplus. Family size is, therefore, considered as one of the independent variable in the marketed surplus function. The total number of family members irrespective of their age and sex is constituted as family size and is considered to have an inverse effect on marketed surplus of milk.
- iii. **Education Level:** The consumption/marked surplus of milk is influenced by the education level of the household, who is one of the important decision maker in the family. It also affects the production of any household.
- iv. **Price of Milk:** The price of milk differs in different seasons for the milk of different breeds of animals. Therefore, weighted average price of milk was taken as an explanatory variable in the marketed surplus function and calculated for each household as follows:

$$\text{Weighted average price} = \frac{\sum P_i W_i}{\sum W_i}$$

Where,

$P_i$  is the price per litre of  $i^{\text{th}}$  type of milk

$W_i$  is the total quantity in volume of  $i^{\text{th}}$  type of milk sold in the household.

- v. **Land Holding:** Larger the operational land holding, larger would be the agricultural by-product available for milk production. Thus, total operational land holding is considered as a variable influencing the marketed surplus of milk and is included as an explanatory variable in the model.
- vi. **Membership:** Membership in Women dairy co-operatives (WDCS) is considered as an important variable as WDCSs provide guaranteed procurement of milk as well as input supply for enhanced milk production. The membership is hypothesized to have a positive impact on marketed surplus of milk.

#### Specification of Marketed Surplus Function:

$$Y = f(X_1, X_2, X_3, X_4, X_5, D_1)$$

where,

$Y$  = Marketed surplus of milk (litre/day)

$X_1$  = Total milk production/herd size (litre/day/animal)

$X_2$  = Family size (No.)

$X_3$  = Education score of women earner

$X_4$  = Weighted Average Price of milk (₹/litre)

$X_5$  = Operational land holding of the producer household (hectares)

$D_1$  =Membership dummy (1, if member; 0, otherwise (non-member))

#### Educational Score of the Women Earner

Since education plays an important role in decision-making and managerial skills, the education score of women earners of each household was considered a factor affecting the marketed surplus of milk. The scale prepared by Trivedi and Pareek (1963) was used, the weightage of which are as follows: Illiterate, 0; Read and write, 1; Primary, 2; Secondary, 3; High School, 4; Intermediate, 5; Graduation and above, 6.

#### RESULTS AND DISCUSSION

Owing to the short shelf life of milk in an unprocessed form, it is pertinent to examine the production, consumption and marketed surplus of milk among different herd size category of the households. It is required to identify the category of milk producers who contribute maximum share in the marketed surplus of milk. Thus, the present section is devoted to provide information on milk production, consumption and marketed surplus of milk and factors affecting marketed surplus of milk in the study area. Table 1, below depicts the average milk production, consumption and marketed surplus of milk for both member and non-member households.

From a perusal of Table 1, it is evident that the average daily milk production is more in case of large farmers for both members and non-member households. This is due larger herd size in case of large herd size categories. Among the member and non-member groups, the production is more for member groups across all herd size categories as the members receive a lot of benefit from being the member of WDCS in the form of inputs and credit support. Large herd size categories in case of both member and non-member group have highest average daily consumption due to larger production. As the production is more, they convert more of raw milk as dairy products like khoa, ghee etc. The average marketed surplus is more in case of large herd size categories in case of both member and non-member groups. Among the groups, the marketed surplus is more in case of member groups. The marketed surplus of milk as a proportion of total milk production is highest in case of small farmers both for member and non-member group which is in conformity with study carried out by Saha (1998). But in the study carried out by Siwach and Dhaka (1993) the results obtained were opposite as large herd category had the largest marketed surplus proportion in total milk production.

The milk that is retained at home is either consumed in raw form or processed. Table 2 depicts the utilization pattern of milk retained at home.

**Table 1: Average daily milk production, consumption and marketed surplus**

Herd size categories	(Litre/day/household)					
	Average milk production		Average consumption		Average marketed surplus	
	Member	Non-member	Member	Non-member	Member	Non-member
Small	21.43	19.43	2.95 (13.77)	2.87 (14.78)	18.48 (86.23)	16.56 (85.22)
Medium	47.30	40.34	4.97 (10.51)	4.56 (11.31)	42.33 (89.49)	35.78 (88.69)
Large	64.41	50.50	6.94 (20.16)	5.87 (11.62)	57.47 (79.84)	44.63 (88.38)
Overall	39.73	35.58	3.97 (9.99)	3.78 (10.62)	35.76 (90.01)	31.80 (89.62)

**Table 2: Utilization pattern of milk retained at home**

Herd size category	(l/day/household)					
	Total quantity of milk retained at home		Milk consumed as liquid		Milk converted into milk products	
	Member	Non-member	Member	Non-member	Member	Non-member
Small	2.95	2.87	1.15 (38.98)	1.02 (35.54)	1.80 (61.01)	1.85 (64.45)
Medium	4.97	4.56	1.98 (39.83)	1.52 (30.58)	2.99 (60.16)	3.04 (66.66)
Large	6.94	5.87	2.46 (35.44)	2.12 (36.11)	4.82 (69.45)	3.75 (63.88)
Overall	3.97	3.78	1.52 (38.83)	1.32 (34.93)	2.45 (61.17)	2.46 (65.07)

Figures in parentheses show the percentage to total quantity retained at home

Thus, a perusal of Table 2 show that about 65 per cent of milk retained at home is converted to milk products in case of both member and non-member group. The remaining 35 per cent is consumed in liquid form.

The impact of membership on marketed surplus was further analysed through regression analysis. The choice of a specific functional form was based on the economic criteria i.e. sign and value of the estimated parameters while statistical criteria depended on the statistical significance of estimated parameters and co-efficient of multiple determination ( $R^2$ ). Out of the four types of functional forms, viz. Cobb-Douglas, Linear and Semi log (both linear-log and log-linear), Cobb-Douglas form was found to be the best fit. Table 3 depicts the parameter estimates of the regression analysis.

A close perusal of Table 3 showed that the Coefficient of Multiple Determination ( $R^2$ ) was 0.657 which indicated that 65.7 per cent of total variation in the marketed surplus of milk were explained by the variables included in the selected regression model.

**Table 3: Parameter estimates of factors affecting marketed surplus**

Variables	Regression coefficient
Constant	6.34
Herd size ( $X_1$ )	0.67***
Family size ( $X_2$ )	-0.09
Education ( $X_3$ )	0.08
Price ( $X_4$ )	1.16**
Land holding ( $X_5$ )	0.05
Membership ( $D_1$ )	1.12***
$R^2$ (Per cent)	0.657

Figure in parentheses indicate the standard error of regression coefficient.

\*\*\* and \*\* Significant at 1 and 5 per cent level

The price of the milk was observed to be very responsive, most important statistically significant ( $p < 0.05$ ) and stimulating factor affecting the marketed surplus of milk. On an average, one per cent increase in price of milk resulted in an increase of marketed surplus by 1.16 per cent. Also, this positive direction of the price coefficient had indicated that there still existed a possibility of raising the price of milk to induce the producer sellers for production and sparing more milk for marketing. This had further reflected that when price of milk increased, the milk producers would tend to add more milch animals and hence more marketed surplus of milk in order to reap higher income from dairying.

It was found that the regression coefficient of milk production per unit herd of animals was found to be positive and statistically significant ( $p < 0.01$ ). On an average, one per cent increase in milk production per unit herd of animals resulted in an increase in marketed surplus of milk by 0.67 per cent. It was observed as per the expected sign, obviously when the production per unit

herd of animals increased, the marketed surplus also increased. Similar results were obtained by Kumar (2009) and Khovieo (2011) in their studies.

Membership in WDCSs had a positive and significant ( $p < 0.01$ ) impact on marketed surplus of milk. WDCSs help in enhancing the production of milk as they provide inputs at subsidised price. Also, the procurement of milk is guaranteed by the WDCS. The WDCSs also organise training programmes for new technologies which further act as an important factor for enhancing milk production. On an average, one per cent increase in membership resulted in an increase in marketed surplus of milk by 1.12 per cent.

The size of operational land holding showed a positive and non-significant impact on marketed surplus of milk. With increase in one per cent area of land holding, marketed surplus increased by 0.05 per cent. It can be looked into another way that marketed surplus in the study area will be more if more area can be put under the cultivation of fodder crops via production enhancement of milk. Family size of households was found to be another determining factor in the marketed surplus of milk. The regression coefficient of family size was found negative but statistically non-significant. On an average, addition of one member in the family was expected to decrease the marketed surplus of milk by 0.09 per cent. This implied that with an increase in family size, there was decline in the marketed surplus of milk because of more milk consumption requirement in the family. However, the regression coefficient of education score of households was found positive but was not significant indicating non-significant impact of education on marketed surplus of milk. All these results are in conformity with those obtained by Chauhan and Sharma (1990), Kumar (2009) and Khovieo (2011) in their studies.

## CONCLUSIONS

The study concluded that the marketed surplus was about 90 per cent of production in the study area. Marketed surplus of milk is affected by many factors such as herd size, price of milk, size of operational land holding, education, family size, membership of co-operative society etc. Among these factors, herd size, price and membership have a positive and significant impact on marketed surplus of milk which is in conformity with the results obtained by Chauhan and Sharma in their study in Bareilly district of Uttar Pradesh (1990). It was further revealed from the study that marketed surplus of milk was higher for members (37.27 l/day/ household) than non-member (33.14l/day/ household). A higher marketed surplus implies that a higher quantity of milk is available for selling. This will further lead to an increase in the income earned by the household. Thus, if the dairy farmer has to increase his income then membership in dairy co-operative societies plays an important role.

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## Economics of Storage of Onion in Jhunjhunu District of Rajasthan

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### ABSTRACT

A study was undertaken to examine the economics of storage in onion supply chain in the Jhunjhunu district which is one of the major onion growing district of Rajasthan. A total sample size of 75 onion growers was taken from Jhunjhunu district. In Jhunjhunu district generally farmer's store onion in storage (under ambient conditions) in the months May to October every year after harvesting the onion crop. The out of the total quantity of marketed surplus (11519.90q), 5221.97q onion produce was stored by the onion growers (54.66 per cent) in onion storage at farm level by the sample farmers during May to October, 2011 period at different locations in Jhunjhunu district. 14.68 per cent of onion is lost during storage period owing to post harvest losses. Maximum return from onion marketing was received during October month (34.24 per cent) due to shortage of produce in market. An overall average profit of 9.98 per cent was obtained by onion growers during six months storage period. The major reasons for storing onion by farmers were for home consumption (97.6 per cent) and to reap benefits of higher prices (92.7 per cent). Majority of farmers (58.5 per cent) adopted improved methods of storage. About 90.2 per cent farmers reported that lack of knowledge about proper scientific methods for storage of onion was the major problem faced by farmers. The storage of onion could lead to double farmers' income and could farmers' could fetch better prices if onion sold when there is more demand in market.

### Keyword

Economics, onion, storage

### JEL Codes

C82, D24, O13, Q13

### INTRODUCTION

An onion, today being compared with diamonds indicates its value for a normal household budget. A global review states that China is the first in area and production while India occupies second position in the production and exports to Dubai, Kuwait, Saudi Arabia, Middle East, Malaysia, Singapore, Bangladesh, Sri Lanka etc. Onion is an important commercial vegetable crop. About 82.02 million tonnes onion is produced in the world from 8217 thousand hectares of area. India is one of the major onions producing country with a production of 14.84 million tonnes from an area of 1.01 million hectares.

Onion is one of the most important commercial vegetable crops grown in Rajasthan. It occupies about 25-30 per cent area of the total vegetable crops in the state. It is predominantly a rabi season crop but in kharif season it accounts for about 10-15 per cent of the total production. Rajasthan has a comparative advantage in onion production. In the total area and production in the country, Rajasthan

stands 7<sup>th</sup> position in area and production and productivity in India and contributes about 57.46 ('000 ha) in area and 704.96 ('000 MT) in production (NHB, 2013-14).

Storage is one of the important aspects for post harvest handling of onion. The storage condition extends the period of availability of fresh onion by arresting the metabolic breakdown and decay. In India, currently about 35- 40 per cent of the onion is estimated to be lost as postharvest losses during various post- harvest operations including handling and storage, Anbukkarasi *et al.* ( 2013). Despite the achievement in production technology and availability of good varieties of onion, the post harvest losses during storage is still an ailing cause which leads to significant qualitative and quantitative losses during storage up to 25-30 per cent. The onion postharvest losses estimated worth ₹600 crores were found to be due to desiccation, decay and sprouting (Kukanoor, 2005). The rationale behind such post-harvest losses till today is the unavailability of good storage facilities during post-harvest storage phase. There seems a

big gap between the storage facility and the storage capacity which is ultimately leading to the unforeseeable post-harvest decay and deterioration of onion bulbs. The cold store capacity for fruits and vegetables in India is over 300 lakh million tonnes, out of which most of the cold storage facilities are used for storage of onion and potato. Post harvest losses in onion are approximately ₹1000 crores annually due to desiccation, decay, and sprouting etc. (ASSOCHAM, 2012). Anbukkarasi *et al.* (2013) reported that during off-season the efficient storage facility for onion plays an important role for the consumers as well as for the producers which ultimately prevents serious losses due to rotting and sprouting.

A study was undertaken in Jhunjhunu district to know the pattern of storage adopted by onion farmers. The study also aimed to carryout economic analysis of costs and returns to onion farmers from storage. Also it aimed to throw light on reasons for storage and problem faced by onion farmers in storage.

#### RESEARCH METHODOLOGY

The study was carried out in the Jhunjhunu district of Rajasthan. The methodology for collection of primary data involved structured interview schedule using personal interview method. A structured schedule was prepared for collection of data from 75 onion farmers from district for the fulfillment of objectives. Multistage stage sampling was

adopted: At first stage, only highest onion producing 3 tehsils were selected in district. At second stage 3-4 villages were randomly selected for the purpose of primary data collection in district. At third stage the list of the onion growers along with their operational holdings in each of the randomly selected village was prepared with the help of villagers. From this prepared list of onion growers, 7-8 onion growers were randomly selected from each village for the present study. A total sample of seventy five onion growers from ten villages was selected from district. Data obtained from the survey was analyzed through tabular analysis including appropriate statistical tools.

#### RESULTS AND DISCUSSION

##### An Economic Analysis of Storage of Onion in Jhunjhunu District

Analysis of economics of the storage of onion revealed that out of the total quantity of Marketed surplus bulb yield (11519.90q), 6297.93q onion produce was stored by the onion growers (54.66 per cent) in onion storage at farm level among the selected sampled farmers size groups during May to October, 2011 period at different locations in Jhunjhunu districts (Table 1).

From the Table 2 the results of the study further revealed that out of the total stored quantity in onion storage (6297.93q), 24.39, 31.71, 19.51, 14.63 and 9.76 per cent of stored onion was sold in June, July, August, September and

**Table 1: Average production, marketable and marketed surplus and stored quantity of onion**

Particulars	Quantity
Total onion production by selected farmers (q)	13259.03
Losses in total production at farm level (q)	1186.43
Total marketable bulbs (q)	12072.6
Onion kept for own used (q)	552.7
Total Marketed surplus (q)	11519.9
Quantity of produce sold within one month (q)	5221.97
Share of farmer's sold produce within one month period (per cent)	45.33
Total quantity stored for storage (q)	6297.93
Share of farmer's stored produce in onion storage (per cent)	54.66

**Table 2: Pattern of onion storage, sale and post-harvest losses during storage at farm level in Jhunjhunu**

Storage period of onion at farm level	Jhunjhunu		
	Quantity stored (q)	Quantity sale after storage (q)	Quantity of post harvest losses (q)
Total quantity of onion produce stored by the selected farmers at farm level	6297.93 (100.00)	-	-
Store for 1 month (April-May)	-	-	-
Store for 2 month (May-June)	1536.07	1428.45	107.62
Store for 3 months (May-July)	1997.07	1797.36	199.71
Store for 4 months (May-Aug)	1228.73	995.27	233.46
Store for 5 months (May-Sep)	921.39	709.47	211.92
Store for 6 months (May-Oct)	614.68	442.57	172.11
Quantity sale out after storage by		5373.12	-
Quantity of onion in post harvest losses (Decay, Sprouting and Weight loss) during storage			924.81 <b>(14.68)</b>

Figures within the parentheses are the percentages of the onion stored, sale & post harvest losses at farm level

October months, respectively by the onion producing farmers. It could be inferred from the Table 2 that during storage period, 7.0, 10.0, 19.0, 23.0 and 28.0 per cent post harvest losses were observed in June, July, August, September and October months, respectively. Results of the study also showed that marketable yield 93.0, 90.0, 81.0, 77.0 and 72.0 per cent was obtained from the stored onion for marketing of onion in June, July, August, September and October months, respectively. It can be seen from the overall average of the stored onion Table 2 that in total 14.68 per cent post harvest losses (924.81q) was occurred during six months storage period (May–October) and 84.46 per cent onion was obtained for marketing purpose after storage.

The results presentation in Table 2 showed that all of the onion producers in the Jhunjhunu district sold their maximum percentage of the stored onion after completion of the storage period of three months (31.71 per cent) and minimum percentage (9.76 per cent) of stored onion was sold after October month (after six months storage period). In Jhunjhunu, onion growers not stored onion beyond six months periods (may-October) because of higher percentage of post harvest losses during storage. It is evident from the table that maximum percentage of total quantity of the stored onion (90.24 per cent) sold up to September month in Jhunjhunu district. Borole *et al.* (2013) also reported similar trend in Maharashtra.

Analysis of economics of onion storage on the basis of per quintal storage of onion was calculated on the basis of the information's received by the farmers during survey (Table 3). Results revealed that expenditure cost for storage of

onion ranged from ₹22.28/q (June) to ₹47.80/q (October), which includes amount paid for laboures for sorting and grading, depreciation cost of storage and annual simple interest on basic value. Analysis of economics of onion storage also exhibited that after two months storage of onion (May-June), net profit per quintal from marketing of onion was received ₹22.47 (4.58 per cent). However, in subsequent months July, August, September and October months', net profit was received ₹41.64 (8.50 per cent), ₹81.91 (16.72 per cent), ₹128.48 (26.22 per cent) and ₹167.80 (34.24 per cent), respectively.

The results further showed that a maximum return from onion marketing was recorded in October month (34.24 per cent). In October month in Jhunjhunu district, there was shortage of arrival of onion in the market from within and outside of the states, which create a significant gap in demand and supply of onion in the market. Therefore, the marketing of stored onion by the onion growers in this period received maximum return in Jhunjhunu district.

Study of an economic analysis of onion storage of sample farmers during six months period in Jhunjhunu district exhibited that net profit earned from the onion growers ranged from 9.13 to 43.97 per cent. Analysis of economics of onion storage further revealed that average higher returns 9.13, 13.88, 24.81, 35.14 and 43.97 per cent were earned by 24.39, 31.71, 19.51, 14.63 and 9.76 per cent of the onion growers, respectively from the storage of onion from June to October months (Table 4.). Study also showed that on an average 9.98 per cent net profit was received by the onion growers from the storage of produce during six months storage period. Analysis

**Table 3: Cost and returns from storage of onion in Jhunjhunu district**

Period of storage	Cost			Storage losses (per cent)	Net sale quantity (q)	Sale price (₹/q)	Gross income	Profit	Net Profit realized (per cent)
	Labour charges	Interest	Total						
May	0.00	0.00	0.00	0	1.00	490	490.00	0.00	0.00
May-June	9.20	4.08	22.28#	7	0.93	575	534.75	22.47	4.58
May-July	9.20	8.16	26.36	10	0.90	620	558.00	41.64	8.50
May-Aug	18.40*	12.24	39.64	19	0.81	755	611.55	81.91	16.72
May-Sep	18.40	16.32	43.72	23	0.77	860	662.20	128.48	26.22
May-Oct	18.40	20.40	47.80	28	0.72	980	705.60	167.80	34.24

\*Two sorting are required for storage beyond July; # includes storage cost of ₹9.0/q; Storage losses: Quantity of drying + sprouting + storage rots of bulbs

**Table 4: Net profit from the storage of onion in Jhunjhunu**

Storage period of onion at farm	Jhunjhunu		
	Sample farmers benefited (per cent)	Net profit (per cent)	Net profit per sample farmer (₹)
One month (May- June)			
Two month (May-June)	24.39	9.13	6868.45
Three months (May-July)	31.71	13.88	10446.07
Four months (May-August)	19.51	24.81	18668.89
Five months (May-September)	14.63	35.14	10169.07
Six months (May-October)	9.76	43.97	33116.65
Overall average	41 (100.00)	9.98	7513.49

**Table 5: Overall average per quintal profit of sample farmers (per cent) during six months storage period in Jhunjhunu**

Name of major onion growing districts	Total Number of sample farmers not adopted storage practice	Total Number of sample farmers adopted storage practice	Profit in storage of onion (₹/q)						
			May	May-June	May-July	May-Aug	May-September	May-October	June-November
Jhunjhunu	34 (45.33)	41 (54.66)	0.00 (0.00)	22.47 (4.58)	41.64 (8.50)	81.91 (16.72)	128.48 (26.22)	167.80 (34.24)	-

Figures within the parentheses are the percentage of total

**Table 6: Overall average profit of onion farmer from Sale of stored onion**

Particulars	Quantity
Total sample farmers Storage onion (per cent)	54.66
Per quintal average profit from storage of onion during six months period (₹)	73.72
Per quintal average profit from storage of onion during six months period (per cent)	15.04
Overall average profit of each sample farmer from onion storage (₹)	7513.49
Overall average profit of sample farmer from onion storage (per cent)	9.98

**Table 7: Reasons for storing onion by the farmers in Jhunjhunu**

(N=41)

Particulars	Proportions of sample farmers
<b>Reasons for storing onion</b>	
Top reap benefits of higher prices	92.7
For home consumption	97.6
For seed production	73.2
Non-availability of time to dispose of produce after harvest	34.1
<b>Advantage of storing onion</b>	
Higher price realized	82.9
Protection against decline in prices	12.2
<b>Storage pattern</b>	
Spreading on Kuccha floor	19.5
Spreading on pucca floor	29.3
Spreading on bamboo / wooden mats	51.2
<b>Method of storage</b>	
<b>Traditional</b>	
Keep bulbs in storage by heap method	41.5
Keep bulbs on bamboo structure for proper wreaths & storage of long duration	41.2
	58.8
<b>Improved</b>	
Local technology developed by farmers	58.5
Technology developed by DOGR, Pune / NHRDF, Nashik	83.3
	16.7
<b>Causes of storage losses</b>	
Losses of the onion from wreaths	46.3
Decaying in storage	21.9
Sprouting of onion bulbs	31.7
Inadequate space for storing of onion	46.3
Lack of knowledge about proper scientific methods for storage of onion	90.2

also revealed that each onion grower was on an average earned ₹6868.45, ₹10446.07, ₹18668.89, ₹10169.07 and ₹33116.65 by the sold of stored produce in June, July, August, September and October month, respectively (Table 4). However, overall average net profit of each onion grower of the six months storage was observed ₹7513.49 in Jhunjhunu district of the state (2010-11).

From the Table 5 it could be concluded that overall average per quintal profit of sample farmers during six months storage period was maximum in the period May-September (36.01 per cent) followed by May-October (34.24 per cent) and lowest in months of May-June (4.58 per cent) in the study area. From the Table 6 it could be concluded that 54.66 per cent sample farmers adopted storage of onion in Jhunjhunu district and per quintal average profit from storage of onion during six months period was observed ₹73.72 (15.04 per cent). Overall average profit of each sample farmer from onion storage was found to be ₹7513.49 (9.98 per cent).

It can be seen from Table 7 that the major reason for storing onion by farmers were for home consumption (97.6 per cent) to reap benefits of higher prices (92.7 per cent), followed by seed production (73.2 per cent) and (34.1 per cent) reported the non-availability of time to dispose of produce after harvest as one of the reason for onion storage in Jhunjhunu district. Regarding advantages of storing onion, 82.9 per cent farmers stated higher price realized in off season selling and 12.2 per cent told that it protects against decline in prices. About 19.5 per cent farmers reported that they spread onion on kuccha floor for storing, 29.3 per cent farmers spread onion on pucca floor and rest 51.2 per cent farmers spread onion on bamboo or wooden mats.

In Jhunjhunu district traditional method of storage was adopted by 41.5 per cent farmers among which 41.2 per cent kept bulbs by heap method and rest 58.8 per cent kept bulbs on bamboo structure to store onion for long duration. While 58.5 per cent farmers adopted improved method of onion storage out of which 83.3 per cent adopted local technology developed at farm level and rest 16.7 per cent adopted the

technology developed by DOGR, Pune/ NHRDF, Nashik. In Jhunjhunu district 90.2 per cent farmers reported that lack of knowledge about proper scientific methods for onion storage one of the key problems resulting in high losses at farm level storage. It was found that 46.3 per cent sample farmer reported losses of onion from wreaths as major cause of storage losses. The 46.3 per cent farmers considered inadequate space for onion storing as key hindrance, about 31.7 per cent farmers considered sprouting and 21.9 per cent farmers reported decay as major problems causing storage losses.

#### CONCLUSIONS

The study concludes that onion storage at farm level on an average gives 9.98 per cent profit to onion growers during six month storage. Highest returns can be obtained by storing up to the month of October. Also, the major reasons for storing onion by farmers were for the home consumption and to reap benefits of higher prices. However lack of knowledge about proper scientific methods for onion storage is one of the key problems leading to high losses at farm level storage. Therefore, there is an urgent need of training the onion growers on scientific techniques for storing onion at farm level, if the vegetable production is to be sustained on a profitable basis in the region. Appropriate farm level storage needs to be given due attention for reducing post harvest losses.

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## **Doubling the Farmer Income by Cooperative Sugar Factory- A Case Study of Shree Vighnahr Cooperative Sugar Factory in Maharashtra**

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### **ABSTRACT**

*The cooperation and coordination is the basis of human society. First builds the society while other manages it. The beauty of the rural cooperative movement is these big establishments of hundreds of crores of rupees are owned by semiliterate and poor farmers. Indian sugar production is characterized by a cyclic production pattern with typical sugar cycles lasting 2-3 years, as production adjusts to fall in price which in turn leads to lower supplies, price increase and higher production. In Maharashtra there was only one sugar factory in 1950-51. The numbers of sugar factory was increased up to 202 in 2015 (Sugar Commission rate Maharashtra, Pune, 2015). Maharashtra state has been purposively selected for the study as it has highest number of cooperative sugar factories in India. From the study it is proved that high variations in trends in arrival of sugarcane for processing in selected sugar cooperative were observed mainly due the rotation of crops like wheat with sugarcane is being followed by local farmers. This can be avoided by stabilizing the sugarcane prices and immediate returns to the farmers.*

### **Keywords**

Cooperative, farmers, Maharashtra, production, sugar

### **JEL Codes**

C33, C39, C81, C83, C88, D02, D21

### **INTRODUCTION**

The Indian domestic sugar market is one of the largest markets in the world, in volume terms. India is also the second largest sugar producing geography. India remains a key growth driver for world sugar, growing above the Asian and world consumption growth average. Globally, in most of the key geographies like Brazil and Thailand, regulations have a significant influence on the sugar sector. Perishable nature of cane, small farm landholdings and the need to influence domestic prices; all have been the drivers for regulations (Kadam, 2012).

Worldwide, 123 countries are producing sugar of which only sugar beet is grown in 43 countries and only sugarcane is grown in 71 countries while both sugarcane and sugar beet is grown in 9 countries. Brazil and India are the world's two largest sugar producers. Together, they have accounted for over half the world's sugarcane production for the past 40 years. The EU is the third-largest producer and accounts for around half the world's

sugar beet production (Hand Book of Sugar Statistics, 2013).

The percentage shares and tri-annual averages of world sugar consumption and 12 identified major sugar consuming countries during different time periods indicated that global sugar consumption has continued to increase from 110.16 million MT in 1989-1992 to 158.86 million MT in 2010-13.

Global imports of sugar remain more diversified than exports and are spread over a larger group of countries including the European Union, USA, China, Indonesia, Russian Federation, Malaysia and South Korea. Of the 168 sugar importing countries, top 10 countries accounts for 47 per cent of world import. The leading sugar importing country is EU having share of 7.42 percent in world sugar import. Indonesia, China, USA, and UAE stand on 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> place respectively. Being so much of imports taking place throughout the world, there are different sugar import and production policies

practiced by different nations to protect their domestic produce from competition. India's share in the world sugar import was only 1.28 per cent of total sugar import, 2010-2013 (APEDA Report 2012-2013).

The Indian Sugar Industry, with an annual productive capacity of over 25 million MT, stands out to be the second largest in the world after Brazil, accounting for around 15 per cent of the global sugar production (Farm Statistics, 2014). The country consumes approximately 22 MT of sugar annually, with Maharashtra contributing over 60 per cent of it while the rest of the output come from states like Tamil Nadu, Karnataka, Uttar Pradesh and Madhya Pradesh (Ashwani & Vijaykumar, 2005). The sufficient and well distributed monsoon rains, rapid population growth and substantial increases in sugar production capacity have made India the largest consumer and second largest producer of sugar in the world. Highly fragmented with organized and unorganized players, the sector supports over 50 million farmers and their families, making significant contribution towards socio-economic development in the rural areas of the India (Herekas & Shinde, 2012).

Sugarcane area and productivity differ widely from country to country. Brazil has the highest area (5.34 million hectares) while Australia has the highest productivity (85.1 tons per hectare). India ranks second among the sugarcane growing countries of the world in both area and production after Brazil with an area under sugarcane cultivation of 4.94 million hectares with an average yield is 68.6 tons per hectare.

Global sugar consumption has grown by about 2 per cent per annum, while in India the consumption has been higher at about 3.5 per cent per annum.

#### METHODOLOGY

Both primary and secondary data were collected for the study

##### Primary Data

The primary data forms an important component of any research investigation. The data were collected with regard to trends of arrival of cane for processing to the selected cooperative sugar factory. Primary data were collected using a structured questionnaire encompassing a number of variables which could arrive at the conclusions.

##### Secondary Data

secondary data required were collected from Indian Sugar Mills Association, National Federation of Co-operative Sugar Factories, Sugar Commissioner rate Maharashtra (Pune), websites, journals, published reports, websites, related govt. departments, research stations, and records of cooperative sugar factories' Association, Commissioner of Industries, cooperative sugar factories and the traders.

##### Analytical Techniques Employed

##### Compound growth rate

For evaluating the trends of arrival of cane for processing, compound growth rate was estimated by

using exponential method of the following type.

$$Y = ab^t$$

$$\text{Log } y = \text{log } a + t \text{ log } b$$

Where,

t = base period in number of years (1, 2, 3...n)

y = number of cooperative sugar factories

b = (1 + r)

r = compound growth rate and

a = constant

In log form b was calculated by using the formula.

$$\text{log } b = \frac{\sum t \text{ log } Y - (\sum t \sum \text{ log } Y / n)}{\sum t^2 - (\sum t)^2 / n}$$

Where,

n = number of years

The per cent of compound growth rate is,

$$[(\text{Anti log of } b) - 1] \times 100$$

The standard error of growth rate (SEr) was estimated by using the following formula

$$SE_r = \frac{\sqrt{\text{log } b \sum (\text{log } y)^2 - (\sum \text{log } y)^2 - (\text{log } g)^2 \sum T^2}}{\text{log } e(n-2) \sum T^2}$$

Where,

$$T = \bar{t} - t$$

The Student 't' test was used to test the significance of growth rates.

$$T = \frac{r}{SE(r)}$$

##### Garrett Ranking Method

The Garrett ranking technique was used to study the opinion of the sugar factory official. Regarding the constraints faced by them in construction and maintenance of sugar factory. The ranking given by the respondents to various attributes has been subjected to Garrett ranking. Garrett percentages were calculated by using the following formulae.

$$\text{Per cent position} = 100 \left( \frac{R_j - 0.5}{N_j} \right)$$

Where,

R<sub>ij</sub> = Rank given for the i<sup>th</sup> items by the j<sup>th</sup> individual.

N<sub>j</sub> = Number of items ranked by the j<sup>th</sup> individual.

By using score card prepared by Garret, scores were allocated to the percentage values. Mean of Garret scores was calculated for each attribute. Attribute with highest mean score is considered as a major constraint faced by the selected cooperative sugar factory.

##### Trend in Arrival of Cane for Processing and the Capacity Utilization

Maharashtra has the highest recovery of sugar in India, an estimated average of 11.30 per cent, and is estimated to produce the largest quantity of sugar of any state at 8.58 million tons. The crushing capacity of factories is generally between 2500-5000 TCD; almost 88 percent of factories are co-operatives and 12 percent are privately owned. More than 25 percent of these factories have already started or are in the process of adopting co-

**Table 1: Trend in arrival of cane for processing in the selected unit**

Year	Sugarcane milled (MT)	Per cent change over last year
2004-05	5.8	-
2005-06	2.50135	-56.89
2006-07	6.09143	143.6
2007-08	9.64221	58.29
2008-09	9.49	-1.56
2009-10	5.20782	-45.20
2010-11	8.16341	56.92
2011-12	11.3275	38.73
2012-13	9.1991	-18.82
2013-14	9.4365	2.61
	Per cent change in 2013-14 over 2004-05	62.76
	CGR	0.049877

Source: Shree Vighnahar Cooperative Sugar Factory

generation of electricity for additional income. (ISMA, 2014). An attempt has been made to study the year-wise changes in arrival of sugarcane in selected sugar cooperative. Due to scarcity of availability of raw material install capacity is not fully utilized. The selected sugar cooperative is having capacity of crushing 15 MT of sugarcane per year. But as seen from Table No.1 that the arrival of sugarcane for processing is not up to the capacity of unit. Due to less cultivation early harvesting of sugarcane is done which gives less recovery percentage.

Though, there has been frequent fluctuations during the one decade period under study, the percentage change of Sugarcane milled in 2013-14 over 2004-05 was 62.76 and the compound growth rate was 0.049 indicating a steady positive growth.

#### Patterns of the Arrivals of Cane and the Factors Influencing Them

The crushing season in Shree Vighnahar Cooperative Sugar Factory starts from October, when the ratoon crop of previous year's plantation is harvested, and reaches its peak in January (15233 tons) before finally ending in April or May of the next year. But based on cane availability, the start of the crushing season may be postponed by one to one and a half months in different states of the country.

The figure 1 represent pattern of the arrival of sugarcane for processing at Shree Vighnahar Cooperative Sugar Factory during the year 2013-14. Arrival is highest in the month of January with 15233 tons of sugarcane while it is minimum at the beginning and ending of crushing season which is October (10005 tons) and May (9720 tons).

#### Factors Influencing Arrivals of Sugarcane

The sugar cane crop has been in growth mode though there have been fluctuations and a steady increase came in last 10 years. The arrivals of sugarcane for processing

**Table 2: Patterns of the arrivals of cane for processing in the selected unit**

Month	Arrival of sugarcane (tonnes)
April 2013	10728
May 2013	9720
June 2013	0
July 2013	0
August 2013	0
September 2013	0
October 2013	10005
November 2013	10525
December 2013	12997
January 2014	15233
February 2014	13227
March 2014	11930

**Table 3: Factors influencing arrivals of sugarcane**

Nature of problem	Garrett score	Total score	Garrett ranking
Government interventions	82	42	VII
Industry's support	70	52	V
Cane support price	63	82	I
Profitability of sugarcane farming	58	58	IV
Political interferences	52	48	VI
Price fluctuations of sugar	48	70	II
Ground water availability	42	63	III

depends on following factors-

1. Government/State Agriculture Departments' input on field extension, seed varieties, crop maintenance.
2. Cane development programs which involve Industries' support to farmers by providing raw material.
3. Increase in cane support price covering more than input costs resulted in farmers' positive response towards sugarcane cultivation.
4. The fact that Sugarcane farming is more profitable than any other cash crop in India resulted in crop switch leads to more crop area under sugarcane due to better return.
5. Sugar sector is vulnerable to political interest. Most of the Co-operative sugar industries in India e.g. in Maharashtra find difficult to pay for the sugarcane supplied by the farmers.
6. Simultaneously fluctuations in the prices of sugar and decreasing ground water availability for irrigation have negative impact on Sugarcane arrivals for processing.

The above factors were taken for analysis and are given Garrett Ranking for their better understanding. 30 farmers were taken randomly for their response on above statements and accordingly Garrett Ranking chart is

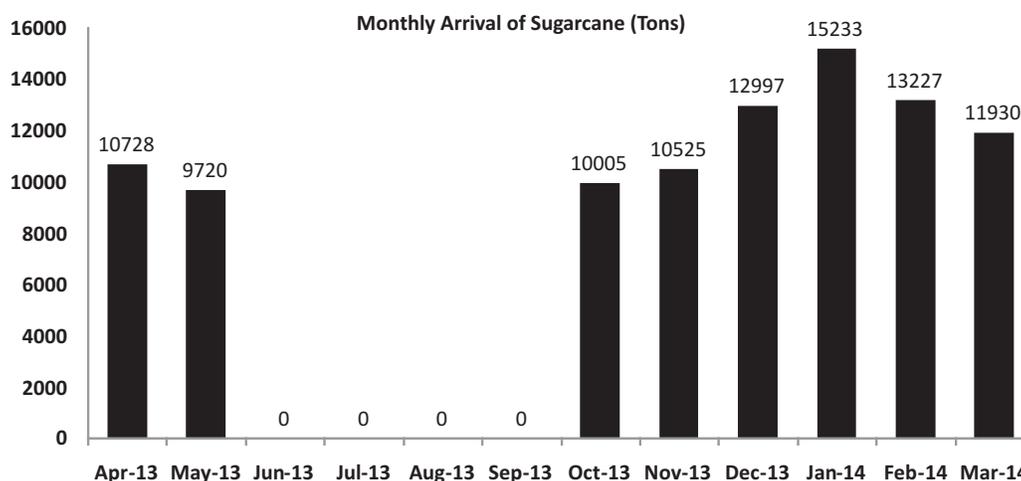


Figure1: Patterns of the arrivals of cane for processing in the selected unit

prepared and presented in Table 3.

The analysis stated the cane support price and price fluctuations of sugar as major factors influencing arrivals of sugarcane ranking them as 1<sup>st</sup> and 2<sup>nd</sup> in the enlisted factors with total scores of 82 and 70 respectively. The analyses have stated ground water availability as a factor with 3<sup>rd</sup> rank and a total score of 63. The analyses have listed the profitability of sugarcane farming and industry's support as 4<sup>th</sup> and 5<sup>th</sup> ranks with total scores of 58 and 52 respectively. The political interferences and government interventions are listed as 6<sup>th</sup> and 7<sup>th</sup> ranks with mean scores of 48 and 42 indicating them as minor factors influencing arrivals of sugarcane. Therefore, price is considered as the most effective influencing factor for arrivals of cane.

### CONCLUSIONS

From the study we can conclude that high variations in trends in arrival of sugarcane for processing in selected sugar cooperative were observed mainly due the rotation of crops like wheat with sugarcane is being followed by local farmers. This can be avoided by stabilizing the sugarcane prices and immediate returns to the farmers. The problem of low capacity utilization by selected sugar cooperative is being faced due to uneven and inadequate supply of sugarcane for processing. There is also a need

for an infrastructural enhancement along with better technology and efficient management.

### SUGGESTIONS

Proper utilization of by-products may give much more profit to the selected cooperative unit. It is very essential that the sugar cooperative can maximize its profit by making optimum use of resources, by introducing professional management strategies at all levels.

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## **Export Opportunity of Agricultural Commodities of India: Revealed Comparative Advantage Approach**

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### **ABSTRACT**

The doubling the income of farmers are possible by different ways, out all trade in international market or produce that product which has comparative advantages over the world agricultural market. Thus we try to understand the comparative advantage of India's in cereals, legumes, horticulture crops & products, livestock & products and processed product trade with the world agricultural export market and also find the position of new entrant in the agricultural in context to International market. To study India's competitiveness, index is calculated, the revealed comparative advantage (RCA). Using author's calculation based on data collected from source of USDA foreign agriculture services analysis, USA. For better understanding of sector specific comparative advantages, in the study total world agricultural export taken instead of total world export. The Index results indicate that India has a strikingly high comparative advantage and specialization in rice, groundnut, pulses, fresh onion, guar gum, fresh mango, fresh grapes, and fruits and vegetables seeds and specialization over the world agricultural exports. It further revealed that the India has also developed comparative advantage in processed products categories as in cucumber & gherkins, dried & preserved vegetables, milled products and other fruits vegetables and in livestock product the albumin, buffalo meat and casein.

### **Keywords**

Agriculture products, International trade, revealed comparative advantage (RCA)

### **JEL Codes**

B21, P33, Q10

### **INTRODUCTION**

It is generally recognized that trade is essential for growth and that growth is critical for poverty reduction. Production and trade of agricultural commodities continues to play a major economic role in many developing countries including India, as they are mostly dependent on agriculture. It is generally recognized that trade is essential for growth and that growth is critical for economic development. The International trade thrives on the comparative advantage that economies offer, as proactive players in the world market. While Ricardo laid down the basic tenets of comparative advantage, Balassa (1965) developed the concept of revealed comparative advantage (RCA). The term thus connotes the idea that countries specialize in export items, which they can produce at lower cost in comparison to the world. In Balassa's (1986) view, the comparative advantage that a country enjoys primarily depends on its physical and human capital endowments.

The paper attempts to assess the RCA scene of India. Has the country's RCA undergone any change and if so, which agricultural commodity are the front-runners in this change. Has the composition of several commodities where India enjoys comparative advantage; it indicates the structure of the economy. India's agri-exports can be divided into five broad categories, i.e. export of a) Cereals b) Legume c) Processed product d) Horticulture crops and product e) Livestock product. Raw products exported are essentially of low value high volume nature, while semi processed products are of intermediate value and limited volume and processed ready-to-eat products are of high value but low volume nature. The major agri-exports of India are rice, groundnut, fresh onion, guar gum, and casein, cucumber & gherkins, buffalo meat and dried & preserved vegetables. Value of agri-exports to total exports of the country has been ranging between 15 to 20 per cent. For understanding the competitiveness in international market, The Revealed Comparative

Advantage (RCA) has calculated for agricultural commodity for the period of 2010 to 2014.

## METHODOLOGY

### Revealed Comparative Advantage (RCA)

The positive impact of trade liberalization and expansion can indirectly be measured by the revealed comparative advantage (RCA). The RCA in theory provides an index measure of changes in comparative advantage (Bender and Li, 2002). If the RCA is above 1 the country is said to be specialized in that sector and if the RCA is below 1 it is said not to be specialized (or 'under-specialized'). Since the IRCA results in an output which cannot be compared on both sides of 1 (its neutral value) 1. The concept of RCA is grounded in conventional trade theory. The original RCA index, formulated by Balassa (1965), can be written

$$RCA = \frac{\frac{X_{ij}}{\sum X_{ij}}}{\frac{X_{iw}}{\sum X_{iw}}}$$

Where,

$X_{ij}$  represents  $i^{\text{th}}$  country's export of commodity  $j$ ,  $\Sigma$

$\Sigma_{ij} X$  is total export of country  $i$ ,

$X_{iw}$  is world export of commodity  $j$ ,

$\Sigma X_{iw}$  is total world agricultural export

For better understanding of sector specific comparative advantages, in the study total world agricultural export taken instead of total world export.

### Symmetrical Revealed Comparative Advantage (RSCA)

Vollrath (1991) made suggestion of taking a log transformation of the RCA index as a solution to the asymmetry problem, but it also added another problem in that the RCA would not be defined in the case of zero export, i.e. when  $RCA=0$ . However, another symmetrical index without the zero-exports issue was provided by Dalum *et al.* (1998), which we call here symmetrical revealed comparative advantage (RSCA) (Sanidas and Shin, 2009):

$$RSCA = \frac{RCA - 1}{RCA + 1}$$

The RSCA is an approximation of a log transformation of the RCA (De Benedictis and Tambari, 2001), which ranges from -1 to +1 and is equal to 0 at the comparative advantage neutral point, where  $RCA=1$ . This index therefore is symmetric

Being a simple transform of RCA, the distribution of RSCA thus does not have stable mean over space and time, which gives suspicion on its comparability. However, it is considered that it has an advantage especially when econometric analysis is taken place. Laursen (1998) shows that the distribution of RSCA meets the normality assumption more frequently than of RCA. However, Benedictis and Tambari (2002) argue that

reducing asymmetry of RCA does not necessarily imply obtaining normality.

### Sources of Data

The data used in this study is secondary data collected from different official sources for the years from 2010-2014. The export data related to (value in US\$ of millions) of 33 commodities for India and world collected from USDA foreign agriculture services <http://www.fas.usda.gov/data>. Yearly export data and international prices for agricultural products have been obtained from various publications of USDA in US\$ million. Agriculture products have been grouped into six broad categories, cereals, Legumes, horticulture crops & product, livestock & products and processed products. Cereal & legume included all commodities like rice, wheat, other cereals, Maize, pulses and groundnuts. Cocoa products, floriculture, fresh grapes, fresh mangoes, fresh onions, fruits & vegetables seeds, guar gum, natural honey, other fresh fruits, other fresh vegetables and walnuts in the horticulture crops and products category. In livestock and products, included albumin, animal casings, buffalo meat, casein, dairy products, poultry product, other meat, and sheep/goat meat. Cereal preparation, cucumber and gherkins, dried and preserved vegetables, jiggery and confectionery, milled products, other processed fruits and vegetables, processed meat and miscellaneous preparation are included in the processed products group.

### RESULTS AND DISCUSSION

The perusal of Table 1 shows the value of RCA of different commodity exported from 2010 to 2014. If  $RCA > 1$ ; it indicates the commodity is competitive in market. If value of RCA has continuously increased over the year, it revealed that the commodity sustains in the international market and country has specialized in it. The value of RCA of rice was positive and increased from year 2010-2014. It indicated that rice has the comparative advantage in international market and has specialization. As per the results, in wheat the value of RCA was lower than one for initial two years but after that it also shows the positive and increased value, which also developed good reputation in international market during study period. In case of maize has comparative advantages and world agricultural export market.

In horticulture crops and products, the fresh onions have comparative advantage over the world agricultural export from the year 2010 to 2014. So it indicates that fresh onion has highly specialization over the period in international market. The value of RCA of fresh grapes, fresh mangoes, and walnuts was positive and increased from the year 2010 to 2014. Thus it indicated that they have competitive advantage in international market and has specialization.

The results show that the guar gum was bigger player in international export market. The value of RCA of guar gum was higher and continuously increased from the year 2010 to 2014. Thus indicated that guar gum has comparative advantage in international market and has

**Table 1: Revealed comparative advantage for Agriculture export from 2010 to 2014**

Product	2010	2011	2012	2013	2014	Average
<b>Cereals</b>						
Rice	20.53	24.58	36.86	39.94	35.06	31.40
Wheat	0.01	0.51	1.93	4.61	2.06	1.82
Other Cereals	1.08	0.76	0.61	1.27	1.20	0.98
Maize	2.30	5.00	4.74	5.18	2.85	4.01
<b>Legume</b>						
Pulses	5.02	8.24	9.84	10.80	5.65	7.91
Groundnuts	19.72	30.91	19.08	20.59	21.02	22.26
<b>Horticulture crops and products</b>						
Cocoa products	0.13	0.15	0.22	0.31	0.37	0.24
Floriculture	0.55	0.58	0.58	0.57	0.48	0.55
Fresh grapes	2.40	1.76	2.94	4.57	3.89	3.11
Fresh mangoes	2.27	2.43	2.62	3.51	2.40	2.65
Fresh onions	15.14	15.53	17.43	20.33	13.23	16.33
Fruits andvegetables seeds	1.95	2.42	2.05	2.45	2.44	2.26
Guargum	79.35	136.92	135.40	129.30	107.59	117.71
Natural honey	6.81	9.29	6.10	6.64	4.49	6.66
Other fresh fruits	0.14	0.14	0.15	0.21	0.20	0.17
Other fresh vegetables	0.71	1.04	1.01	1.21	1.32	1.06
Walnuts	2.21	2.06	1.73	1.49	0.89	1.68
<b>Livestock andproducts</b>						
Albumin (eggs andmilk)	1.74	1.95	1.84	2.07	1.95	1.91
Animal casings	0.51	0.57	0.53	0.46	0.32	0.48
Buffalo meat	4.72	5.74	5.97	5.81	4.75	5.40
Casein	8.72	4.04	3.52	6.06	5.02	5.47
Dairy products	0.28	0.20	0.21	0.58	0.36	0.33
Poultry products	0.19	0.19	0.29	0.29	0.35	0.26
Other meat	0.02	0.02	0.02	0.00	0.01	0.01
Sheep/goat meat	1.77	1.73	1.54	2.18	0.86	1.62
<b>Processed products</b>						
Cereal preparations	0.80	0.93	0.82	0.81	0.72	0.81
Cucumber and gherkins (Prepared andPreserved)	38.37	46.49	43.21	40.63	36.75	41.09
Dried andpreserved vegetables	5.63	7.47	6.71	6.91	6.51	6.65
Jaggery andconfectionery	0.84	2.71	2.28	0.98	1.18	1.60
Milled products	1.41	2.25	4.64	6.30	4.70	3.86
Other processed fruits andvegetables	1.34	1.59	1.29	1.33	1.09	1.33
Processed meat	0.06	0.05	0.06	0.08	0.03	0.06
Miscellaneous preparations	0.79	0.97	0.94	0.95	0.78	0.88

Source: Based on Authors calculation and data collected from USDA Foreign Agricultural Services <http://www.fas.usda.gov/data>

highly specialization. As per the table other fresh fruits, vegetables was lower than one but it indicated increasing trend, which also developed the good position in international market during this period. In the case of natural honey has comparative advantages and specialization in the world agricultural export.

The results show that livestock products have also acquired good position in agricultural export. In livestock, buffalo meat and casein has also achieved the good position in international market. The value of RCA of buffalo meat and casein have positive and increase over the period from 2010 to 2014. If it indicated that buffalo meat and casein have the comparative advantage in international market

and has specialization. But albumin and sheep/ goat meat had also achieved the good position in world agricultural exports. As per the table RCA of other meat, poultry product, dairy product, and animal casings were less than one. It revealed that India has less competitive advantage in this commodities and no specialization as compared to other in world agricultural export.

As per the table in processed products, RCA of cucumber& gherkins was good competitive advantage in international market and specialization over the year from 2010 to 2014. It revealed that India has comparative advantage in cucumber& gherkins compare to others and also dried & preserved vegetables was hold the good

**Table 2: Symmetrical revealed comparative advantage for Agricultural export from 2010 to 2014**

Product	2010	2011	2012	2013	2014
<b>Cereals</b>					
Rice	0.91	0.92	0.95	0.95	0.94
Wheat	-0.97	-0.33	0.32	0.64	0.35
Other cereals	0.04	-0.13	-0.24	0.12	0.09
Maize	0.39	0.67	0.65	0.68	0.48
<b>Legume</b>					
Pulses	0.67	0.78	0.82	0.83	0.70
Groundnuts	0.90	0.94	0.90	0.91	0.91
<b>Horticulture crops &amp; products</b>					
Cocoa products	-0.77	-0.74	-0.64	-0.53	-0.46
Floriculture	-0.29	-0.26	-0.26	-0.27	-0.35
Fresh grapes	0.41	0.28	0.49	0.64	0.59
Fresh mangoes	0.39	0.42	0.45	0.56	0.41
Fresh onions	0.88	0.88	0.89	0.91	0.86
Fruits & vegetables seeds	0.32	0.41	0.35	0.42	0.42
Guar gum	0.98	0.99	0.99	0.98	0.98
Natural honey	0.74	0.81	0.72	0.74	0.64
Other fresh fruits	-0.75	-0.76	-0.73	-0.66	-0.66
Other fresh vegetables	-0.17	0.02	0.01	0.09	0.14
Walnuts	0.38	0.35	0.27	0.20	-0.06
<b>Livestock &amp; products</b>					
Albumin( eggs & milk)	0.27	0.32	0.30	0.35	0.32
Animal casings	-0.33	-0.28	-0.31	-0.37	-0.51
Buffalo meat	0.65	0.70	0.71	0.71	0.65
Casein	0.79	0.60	0.56	0.72	0.67
Dairy products	-0.56	-0.66	-0.65	-0.27	-0.48
Poultry products	-0.68	-0.68	-0.55	-0.55	-0.48
Other meat	-0.97	-0.97	-0.96	-0.99	-0.99
Sheep/goat meat	0.28	0.27	0.21	0.37	-0.08
<b>Processed products</b>					
Cereal preparations	-0.11	-0.04	-0.10	-0.11	-0.17
Cucumber and gherkins(Prepared and Preserved)	0.95	0.96	0.95	0.95	0.95
Dried and preserved vegetables	0.70	0.76	0.74	0.75	0.73
Jaggery and confectionery	-0.08	0.46	0.39	-0.01	0.08
Milled products	0.17	0.38	0.65	0.73	0.65
Other processed fruits and vegetables	0.15	0.23	0.13	0.14	0.04
Processed meat	-0.89	-0.90	-0.88	-0.85	-0.95
Miscellaneous preparations	-0.12	-0.02	-0.03	-0.03	-0.13

Source: Researcher's calculation based on data collected from USDA foreign agriculture services <http://www.fas.usda.gov/data>

position in international market.

The perusal of Table 2 shows that it has been observed that Rice & Maize (under the category of cereals) has shown improved specialization in agricultural exports during the period of 2010-2014, Pulses & groundnuts falling under legume category, both has showed phenomenal contribution in agricultural exports. Among horticultural crops & products, Guar gum, Fresh onion & natural honey has acquired higher specialization while Floriculture & Cocoa products are among the bottom line. In the category of livestock & products Buffalo meat & casein has comparatively greater specialization in

agricultural exports. However poultry products & dairy products are lagging behind in the rank.

Among all, most of the processed products like cucumber and gherkins (prepared and preserved), dried and preserved vegetables, and milled products has acquired greater specialization in agri. Exports when compared with other processed products.

#### CONCLUSIONS

What to produce is the biggest question in the farmer's fraternity for doubling of income. Because uncertain fluctuation in the price of agricultural commodities and natural calamities. To cope us with this

situation and sustain in the international market the paper concluded that the value of RCA Index, it conclude that rice, groundnut, pulses, fresh onion, guar gum, fresh mango, fresh grapes, natural honey and fruits and vegetables seeds the India had comparative advantage and specialization over the world agricultural exports. It further revealed that the India has also developed comparative advantage in processed products

categories as in cucumber & gherkins, dried & preserved vegetables, milled products and other fruits vegetables and in livestock product the albumin, buffalo meat and casein.

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## Crop Insurance Products in India: An Approach for Risk Management in Agriculture

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### ABSTRACT

The agricultural insurance is considered an important mechanism to effectively address the risk in agriculture. So, the objective of the paper is comparative study of agriculture insurance schemes implemented by government for risk management in agriculture sector. The study indicates that the Maharashtra farmers largely benefited from national agriculture insurance scheme and Rajasthan farmers are largely benefited from MNAIS and WBCIS. The study indicates that highest (Figure 1) number of farmers insured and benefited from NAIS scheme followed by WBCIS. Among the insurance scheme, highest area under insurance covered by NAIS scheme at around 3.39 lakh ha followed by WBCIS scheme. The highest claims were seen in case of national agriculture insurance scheme followed by WBCIS in India.

### Keywords

India, MNAIS, NAIS, risk management, WBCIS

### JEL Codes

G22, Q1, Q14, Q18

### INTRODUCTION

Agriculture production and farm incomes in India are frequently affected by natural disasters and man-made disasters such as fire, low quality seeds, fertilizers and pesticides, price fluctuations in market etc., all these events severely affect farmers through loss in production and farm income, and they are beyond the control of the farmers (Raju & Chand, 2008). The market price is of many crops fluctuating over the period of time. The unstable market price in many markets leads to the ups and downs of income of farmers.

Hence, agricultural insurance is considered an important mechanism to effectively address the risk to output and income resulting from various natural and manmade events (Raju and Ramesh Chand, 2008). Agricultural Insurance is a means of protecting the agriculturist against financial losses due to uncertainties that may raise agricultural losses arising from named or all unforeseen perils beyond their control (www.aicofindia.com, 2008). According to the National Agriculture Policy 2000, "Despite technological and economic advancements, the condition of farmers

continues to be unstable due to natural calamities and price fluctuations". In some extreme cases, these unfavourable events become one of the factors leading to farmers' suicides which are now assuming serious proportions (Raju & Chand, 2007).

Agricultural insurance is one method by which farmers can stabilize farm income and investment and guard against disastrous effect of losses due to natural hazards or low market prices (Raju & Chand, 2008). Bhende (2005) found that income of the farm households from semi-arid tropics engaged predominantly in rain-fed farming was positively associated with the level of risk. Hence, the availability of formal instrument for diffusion of risk like crop insurance will facilitate farmers to adopt risky but remunerative technology and farm activities, resulting in increased income.

To mitigate the risk and to stabilize the price fluctuations directly or indirectly, Government of India has introduced many crop insurance products like crop insurance scheme (1973) comprehensive crop insurance scheme (1985) by General Insurance Company (GIC) for cotton and cereals (rice, wheat, millets, oilseeds and

pulses) respectively. The most recently government has introduced many agricultural insurance products (Table 1) like National Agricultural Insurance Scheme (rabi 1999-2000), Modified National Agricultural Insurance

**Table 1: Comparison of features of different crop insurance scheme in India**

Parameters	NAIS	MNAIS	WBIS
Implementation Year	1999-2000	Rabi 2010-11	Kharif 2007
Objectives	To provide insurance coverage and financial support to the farmers in the event of failure of any of the notified crop as a result of natural calamities and to stabilize the income of the farmers during disaster year	This scheme provides insurance coverage and financial support to the farmers in the event of failure of crops and subsequent low crop yield.	This scheme provides insurance coverage and financial support to the farmers in the event of failure of crops due to Adverse Weather Incidence and subsequent crop loss.
Crops covered	Food crops (Cereals, Millets & Pulses) b. Oilseeds c. Sugarcane, Cotton & Potato (Annual Commercial / annual Horticultural crops)	Food crops which include cereals, millets & pulses O i l s e e d s A n n u a l C o m m e r c i a l / Horticultural crops	The scheme covers major food crops such as cereals, millets & pulses, Oilseeds and commercial / horticultural crops. Crops are selected and notified by State Governments.
Insurance Unit	Village Panchayat (VP)	Village Panchayat (VP)	Depends on the availability of weather stations. Usually at tehsil/block level,
Data Requirement	Past yield data as well as actual yield data	Yield data as well as rainfall data required	Past 25-30 years Weather data required
Indemnity Level	a) 60, 70, and 80per cent based on Yield variability in the past 10 years measured in terms of Coefficient of Variation (CV) (b) Assigned at State level	(a) 80 and 90 per cent Claim experience (as if) in the past 7/10 years measured in terms of 'loss cost' (b) Assigned at District level	(a) Weather triggers beyond which claims becomes payable are set on the basis of past weather data and the correlation of weather parameters with the yield. (b) Assigned at Reference Unit Area (RUA) level
Premium	1.5 to 3.5 per cent for food and oilseeds for normal coverage and Actuarial premium for annual commercial/horticultural crops	Actuarial premium	Actuarial premium.
Farmers covered	All loanee and Non loanee farmers	All loanee and Non loanee farmers	All loanee and Non loanee farmers
Government and liabilities sharing	Premium subsidy of 10 per cent for Small /Marginal farmers. Claims beyond 100 per cent of premium in case of normal coverage Food & Oil Seeds	The premium subsidy by the government ranges from 'ZERO' to 75per cent depending on the premium slabs. Premium subsidy is shared by Centre & State on 50:50 bases.	The premium subsidy by the government ranges from 'ZERO' to 50per cent depending on the premium slabs. Premium subsidy is shared by Centre & State on 50:50 basis
Risks covered	Practically 'all risk' insurance	“All risk' with added advantage of sowing failure cover.	Only parametric weather exigencies (like rainfall, temperature, humidity etc.) are covered.
Prevented / failed Sowing Risk	Presently not covered (covers risk only from sowing)	Prevented/ Failed Sowing Risk to be covered with a benefit of up to 25per cent of sum	Prevented sowing risk to a good extent is correlated with rainfall cover
Post-Harvest losses	Presently not covered (as yield are estimated at harvest time)	Coverage is available up to 2 weeks for harvested crop lying in the field in	Post-harvest losses not covered

**Cont...**

Availing insurance	Only through Banks (RFIs)	Loanee: Banks Non-Loanee: Banks / Channel partners/ Insurance Intermediaries/ Direct	Same as MNAIS
In-season settlement of claims	The claims are settled based on the final yield estimates submitted by States. There is no provision to provide for in- season / on-account settlement of claims	On-account settlement of claims up to 25 per cent of likely claims is paid during the crop season based on composite index	Pay outs are made usually within 45 days from end of risk period, subject to receipt of weather data and premium subsidy
Basis Risk	Basis risk is high as the insurance unit is rarely homogeneous	Basis risk for localized calamities is reduced	Basis risk is high due to poor density of weather stations. However, it can be minimized with Increase in weather station network

Source: Agricultural Crop Insurance Company of India Ltd

Scheme (2013), Weather Based Crop Insurance Scheme (Kharif 2007), Pradhan Mantri Bheema Fasal Yojana (2016) and many others.

**Pradhan Mantri Fasal Bima Yojana (PMFBY):** PMFBY is the new crop damage insurance scheme that has been approved by the Union Cabinet in January 2016 and implemented from the Kharif season same year. It will replace the existing two crop insurance schemes like National Agricultural Insurance Scheme (NAIS) and Modified NAIS. The scheme aims to bring 50 per cent farmers under the scheme within 2-3 years. The new scheme also covers post-harvest losses with yield loss. The scheme covers kharif, rabi crops as well as annual commercial and horticultural crops with premium charged would be up to 2, 1.5, and 5 per cent of the sum insured respectively.

**Unified Package Insurance Scheme (UPIS):** Unified Package Insurance Scheme (UPIS) aims at providing financial protection to citizens associated in agriculture sector, thereby ensuring food security, crop diversification and enhancing growth and competitiveness of agriculture sector besides protecting farmers from financial risks. The UPIS will be implemented in 45 selected districts on Pilot basis from Kharif 2016 season (<http://vikaspedia.in/>). The policy contains 7 Sections among that Crop Insurance is mandatory.

Hence based on above background, the following study has been conducted with objectives to compare the different insurance products introduced by government for risk management in agriculture and to study number of farmers insured, sum insured, subsidy covered, area covered number of farmers benefited under different insurance products in India.

#### METHODOLOGY

The required secondary information of different agriculture insurance products and secondary data related to number of farmers insured, amount of sum insured, subsidy covered, area covered under insurance, number of farmers benefited etc., under different insurance

products was collected from the publications of agriculture insurance company of India limited and various other sources from 1999-2000 to till date. The secondary data of NAIS were from Rabi 1999-2000 to Kharif 2014, of MNAIS were from Rabi 2010-11 to Kharif 2014 and of WBCIS were from Kharif 2007 to Kharif 2014 collected and analysed. The collected data were analysed by using descriptive statistics like mean and percentage share etc., to draw meaningful conclusions and suggest policy.

#### RESULTS AND DISCUSSION

The Table 2 indicates state wise number of farmers insured and benefited under National Agriculture Insurance Scheme from Rabi 1999-2000 to Kharif 2014. The result indicates that the total number of farmers insured around 2.30 lakhs from 1999-2000 to kharif 2014, out of that only 59 thousands farmers benefited under NAIS scheme. The result also indicates that the highest numbers of farmers insured under NAIS were found Maharashtra (17.09 per cent) state followed by Madhya Pradesh and Andhra Pradesh states, whereas highest number of farmers benefited found in Maharashtra state and Andhra Pradesh. The highest area insured under national agricultural insurance scheme were found in Madhya Pradesh (78058 thousand ha) followed by Andhra Pradesh (45583 thousand ha). It indicates that Maharashtra farmers largely benefited from NAIS followed by Andhra Pradesh and Madhya Pradesh states in India. The highest sum insured were found in Andhra Pradesh and Madhya Pradesh. The highest and lowest premium collection under NAIS is found in case of Andhra Pradesh and Madhya Pradesh.

The result (Table 3) indicates that the total number of farmers insured around 9681 thousands from 2010-11 to kharif 2014 under MNAI scheme, out of that total number of farmers only 1656 were benefited. The highest numbers of farmers insured under MNAIS were found in case Rajasthan (33.36 per cent) state followed by Andhra Pradesh and Bihar states, whereas Andhra Pradesh (31.64 per cent) farmers share is more in case of number of

**Table 2: State wise number of farmers insured and benefited under NAIS from Rabi 1999-2000 to Kharif 2014 i.e. For 30 Seasons (As on 5/1/2015)**

States	No. of farmers insured (000')	Area insured (000' Ha)	Amount (₹Crore)			No. of farmers benefitted (000')	
			Sum insured	Premium	Subsidy		Claims
Andhra Pradesh	29952 (13.06)	45583.16 (13.42)	62181.36 (17.78)	1768.16 (16.68)	157.37 (11.30)	4649.11 (13.95)	6730 (11.38)
Assam	396 (0.17)	291.13 (0.09)	807.21 (0.23)	22.54 (0.21)	2.34 (0.17)	16.53 (0.05)	65 (0.11)
Bihar	6037 (2.63)	7377.7 (2.17)	11904.02 (3.4)	303.83 (2.87)	27.1 (1.95)	2306.15 (6.92)	2431 (4.11)
Chhatisgarh	10425 (4.55)	20991.14 (6.18)	11511.43 (3.29)	294.44 (2.78)	19.46 (1.40)	398.57 (1.20)	1706 (2.88)
Gujarat	14870 (6.48)	33886.59 (9.98)	44953.82 (12.86)	1788.61 (16.88)	160.52 (11.53)	6503.47 (19.51)	4946 (8.36)
Haryana	636 (0.28)	769.04 (0.23)	834.96 (0.24)	24.14 (0.23)	0.68 (0.05)	43.36 (0.13)	129 (0.22)
HP	321 (0.14)	248.84 (0.07)	543.77 (0.16)	11.71 (0.11)	5.15 (0.37)	17.83 (0.05)	108 (0.18)
Jharkhand	6277 (2.74)	3767.77 (1.11)	3401.53 (0.97)	84.35 (0.80)	4.51 (0.32)	522.99 (1.57)	2183 (3.69)
Karnataka	13150 (5.73)	20872.42 (6.14)	16418.06 (4.7)	483.98 (4.57)	24.01 (1.72)	1949.4 (5.85)	5223 (8.83)
Kerala	461 (0.2)	414.74 (0.12)	871.66 (0.25)	18.82 (0.18)	2.52 (0.18)	30.63 (0.09)	85 (0.14)
Madhya Pradesh	32332 (14.10)	78058.92 (22.98)	58205.85 (16.65)	1678.16 (15.83)	48.44 (3.48)	4234.32 (12.7)	6459 (10.92)
Maharashtra	39190 (17.09)	32619.85 (9.60)	27084.63 (7.75)	1192.54 (11.25)	315.06 (22.63)	2919.7 (8.76)	10790 (18.24)
Orissa	17313 (7.55)	17018.22 (5.01)	27259.92 (7.8)	684.03 (6.45)	71.63 (5.14)	1830.31 (5.49)	3047 (5.15)
Rajasthan	15059 (6.57)	31379.98 (9.24)	16203.09 (4.63)	457.54 (4.32)	7.38 (0.53)	2621.66 (7.87)	5201 (8.79)
Tamil Nadu	6556 (2.86)	8495.08 (2.50)	18461.54 (5.28)	474.76 (4.48)	233.78 (16.79)	2937.17 (8.81)	2633 (4.45)
Uttar Pradesh	23426 (10.21)	31070.39 (9.15)	33537.82 (9.59)	684.82 (6.46)	52.19 (3.75)	1169.38 (3.51)	4518 (7.64)
Uttarakhand	399 (0.17)	372.51 (0.11)	870.98 (0.25)	19.78 (0.19)	1.79 (0.13)	41.88 (0.13)	119 (0.2)
West Bengal	12364 (5.39)	6223.12 (1.83)	14179.98 (4.06)	595.47 (5.62)	256.49 (18.42)	1122.41 (3.37)	2742 (4.64)
Other states	184 (0.08)	233.58 (0.07)	435.15 (0.12)	11.08 (0.10)	1.93 (0.14)	14.48 (0.04)	38 (0.06)
<b>Total</b>	<b>229349 (100)</b>	<b>339674.2 (100)</b>	<b>349666.78 (100)</b>	<b>10598.75 (100)</b>	<b>1392.35 (100)</b>	<b>33329.38 (100)</b>	<b>59154 (100)</b>

Source: Agricultural Crop Insurance Company of India Ltd, 2015

benefited farmers followed by Rajasthan state farmers. The highest area covered under modified national agricultural insurance scheme was found in Rajasthan (31.07 per cent) state followed by Andhra Pradesh and Bihar. It indicates that Rajasthan farmers largely benefited from from modified national agriculture insurance scheme in India.

The perusal of Table 4 indicates that state wise

number of farmers insured and benefited under Weather Based Crop Insurance Scheme from Kharif 2007 to Kharif 2014. The result indicates that the total number of farmers covered under weather based crop insurance scheme is around 34 thousands from Kharif 2007 to kharif 2014, out of that only 19000 thousands farmers were benefited. The highest number farmers insured (59.30 per cent) and benefited (55.77 per cent) were noticed

**Table 3: State wise number of farmers insured and benefited under MNAIS from Rabi 2010-11 to Kharif 2014 i.e. For 8 Seasons (As on 05/01/2015)**

States	No. of farmers insured (000')	Area insured (000' ha)	Amount (₹ Crores)			No. of farmers benefitted (000')	
			Sum insured	Premium	Subsidy		Claims
AP	1342.00 (13.86)	1428.91 (13.19)	5189.07 (24.29)	539.84 (22.84)	292.75 (20.27)	774.46 (45.04)	524.00 (31.64)
Assam	17.00 (0.18)	12.67 (0.12)	49.54 (0.23)	2.09 (0.09)	0.86 (0.06)	0.63 (0.04)	1.00 (0.06)
Bihar	1223.00 (12.63)	1370.07 (12.64)	2266.79 (10.61)	479.39 (20.28)	343.52 (23.79)	153.9 (8.95)	62.00 (3.74)
Haryana	102.00 (1.05)	210.98 (1.95)	853.04 (3.99)	34.18 (1.45)	14.68 (1.02)	26.07 (1.52)	22.00 (1.33)
Jharkhand	12.00 (0.12)	6.05 (0.06)	14.61 (0.07)	1.32 (0.06)	0.73 (0.05)	0.03 (0.00)	0.00 (0.00)
Karnataka	1026.00 (10.60)	1656.61 (15.29)	2439.94 (11.42)	295.34 (12.5)	176.23 (12.20)	77.89 (4.53)	115.00 (6.94)
MP	79.00 (0.82)	150.79 (1.39)	197.23 (0.92)	7.6 (0.32)	2.99 (0.21)	0.22 (0.01)	0.00 (0.00)
Maharashtra	52.00 (0.54)	49.62 (0.46)	76.21 (0.36)	13.62 (0.58)	9.8 (0.68)	0.00 (0.00)	0.00 (0.00)
Orissa	120.00 (1.24)	87.32 (0.81)	297.07 (1.39)	11.32 (0.48)	4.43 (0.31)	65.10 (3.79)	56.00 (3.38)
Rajasthan	3256 (33.63)	4010.01 (37.01)	3292.80 (15.42)	350.26 (14.82)	199.77 (13.83)	119.8 (6.97)	346.00 (20.89)
Tamil Nadu	476.00 (4.92)	522.47 (4.82)	1283.39 (6.01)	140.22 (5.93)	83.22 (5.76)	204.58 (11.9)	180.00 (10.87)
Uttar Pradesh	747.00 (7.72)	765.57 (7.06)	1896.76 (8.88)	86.69 (3.67)	36.57 (2.53)	219.75 (12.78)	246.00 (14.86)
Uttarakhand	70.00 (0.72)	62.3 (0.570)	209.99 (0.98)	5.86 (0.25)	1.73 (0.12)	3.35 (0.19)	11.00 (0.66)
West Bengal	1149.00 (11.87)	488.47 (4.51)	3185.97 (14.92)	393.11 (16.63)	275.12 (19.05)	73.62 (4.28)	91.00 (5.50)
Other States	4.00 (0.04)	4.2 (0.04)	71.23 (0.33)	0.35 (0.01)	0.2 (0.01)	0.09 (0.01)	1.00 (0.06)
<b>Total</b>	<b>9681.00</b> <b>(100.00)</b>	<b>10836.36</b> <b>(100.00)</b>	<b>21359.41</b> <b>(100.00)</b>	<b>2363.4</b> <b>(100.00)</b>	<b>1444.01</b> <b>(100.00)</b>	<b>1719.49</b> <b>(100.00)</b>	<b>1656.00</b> <b>(100.00)</b>

Source: Agricultural Crop Insurance Company of India Ltd, 2015

from Rajasthan state under WBCIS followed by Bihar and Andhra Pradesh states for both number of insured as well as number of benefited. The highest area covered under weather based crop insurance scheme was found in Rajasthan (63.22 per cent) state followed by Bihar and Andhra Pradesh. It indicates that Rajasthan farmers largely insured and benefited among other states under weather based crop insurance scheme in India. The result indicates that the Rajasthan state farmers are benefited from both modified national agriculture insurance scheme and weather based crop insurance scheme, whereas Maharashtra state farmers are benefited from

national agriculture insurance scheme in India.

The highest (Figure 1) number of farmers insured and benefited from NAIS scheme (2.29 lakh farmers insured and 33 thousands benefited) followed by WBCIS (34146 farmers insured and 19000 farmers are benefited). Among the insurance scheme, highest area under insurance covered by NAIS scheme at around 3.39 lakh ha followed by WBCIS scheme (45 thousand ha). The results are in line with Viswanathan (2015) reported that area covered under crop insurance was high NAIS (23.66 million hectare per year) followed by WBCIS at 9.72 million hectare per year

**Table 4: State wise number of farmers insured and benefited under WBCIS from Kharif 2007 to Kharif 2014 i.e. For 16 Seasons (As on 05/01/2015)**

States	No. of farmers insured (000')	Area insured (000' Ha)	Amount (₹ Crores)			No. of farmers benefitted (000')	
			Sum insured	Premium	Subsidy		Claims
Andhra Pradesh	2881.83 (8.44)	4697.05 (10.21)	11814.59 (18.84)	1178.49 (19.81)	725.48 (18.37)	875.03 (21.45)	2016.44 (10.61)
Assam	4.74 (0.01)	2.66 (0.01)	16.16 (0.03)	1.66 (0.03)	0.83 (0.02)	0.06 (0.00)	0.07 (0.00)
Bihar	6471.29 (18.96)	6815.36 (14.82)	15631.47 (24.92)	1344.04 (22.59)	934.28 (23.66)	832.45 (20.41)	3944 (20.75)
Chhatisgarh	202.21 (0.59)	372.31 (0.81)	726.98 (1.16)	57.28 (0.96)	43.42 (1.10)	61.12 (1.5)	148.52 (0.78)
Gujarat	497.66 (1.46)	413.13 (0.90)	223.95 (0.36)	22.39 (0.38)	19.88 (0.50)	8.57 (0.21)	170.58 (0.90)
Haryana	70.43 (0.21)	119.77 (0.26)	440.61 (0.70)	38.39 (0.65)	29.67 (0.75)	33.88 (0.83)	40.1 (0.21)
Himachal Pradesh	98.7 (0.29)	39.39 (0.09)	510.46 (0.81)	58.76 (0.99)	29.38 (0.74)	48.99 (1.20)	75.71 (0.40)
Jharkhand	225.13 (0.66)	170.60 (0.37)	318.31 (0.51)	29.59 (0.50)	22.01 (0.56)	17.84 (0.44)	186.37 (0.98)
Karnataka	696.08 (2.04)	820.52 (1.78)	1513.27 (2.41)	171.3 (2.88)	98.37 (2.49)	78.87 (1.93)	482.89 (2.54)
Kerala	116.48 (0.34)	82.63 (0.18)	256.12 (0.41)	26.37 (0.44)	16.92 (0.43)	14.56 (0.36)	59.03 (0.31)
Madhya Pradesh	428.55 (1.26)	843.12 (1.83)	1798.31 (2.87)	164.42 (2.76)	115.01 (2.91)	97.43 (2.39)	377.7 (1.99)
Maharashtra	1413.13 (4.14)	1581.43 (3.44)	3830.59 (6.11)	438.86 (7.38)	260.49 (6.60)	259.39 (6.36)	458.82 (2.41)
Orissa	214.43 (0.63)	309.6 (0.67)	389.35 (0.62)	38.93 (0.65)	29.20 (0.74)	19.69 (0.48)	123.53 (0.65)
Punjab	0.02 (0.00)	0.10 (0.00)	0.19 (0.00)	0.02 (0.00)	0.01 (0.00)	0.00 (0.00)	0.00 (0.00)
Rajasthan	20241.37 (59.3)	29071.66 (63.22)	23654.23 (37.72)	2217.82 (37.27)	1537.31 (38.93)	1603.77 (39.32)	10600.09 (55.77)
Tamil Nadu	76.04 (0.22)	72.67 (0.16)	171.98 (0.27)	16.70 (0.28)	11.26 (0.29)	14.35 (0.35)	39.46 (0.21)
Uttar Pradesh	64.27 (0.19)	24.39 (0.05)	68.66 (0.11)	6.28 (0.11)	4.42 (0.11)	2.19 (0.05)	27.98 (0.15)
Uttarakhand	77.62 (0.23)	25.74 (0.06)	233.08 (0.37)	27.85 (0.47)	13.92 (0.35)	36.76 (0.90)	45.79 (0.24)
West Bengal	36.07 (0.11)	19.76 (0.04)	48.17 (0.08)	4.69 (0.08)	3.29 (0.08)	4.45 (0.11)	27.84 (0.15)
<b>Total</b>	<b>34136.42</b> <b>(100.00)</b>	<b>45987.17</b> <b>(100.00)</b>	<b>62714.04</b> <b>(100.00)</b>	<b>5950.34</b> <b>(100.00)</b>	<b>3948.41</b> <b>(100.00)</b>	<b>4078.84</b> <b>(100.00)</b>	<b>19005.57</b> <b>(100.00)</b>

Source: Agricultural Crop Insurance Company of India Ltd, 2015

Figure 2 indicates that the sum insured premium, subsidy and claims under different insurance schemes vs., NAIS, MNAIS and WBCIS in India. Among the various insurance schemes, the highest sum insured were found under national agricultural insurance scheme has contributed followed by weather based crop insurance

scheme in India. The highest claims were seen in case of national agriculture insurance scheme followed by WBCIS in India. The results are in line with Viswanathan (2015) reported that the claims ratio was found to be highest in comprehensive crop insurance scheme and NAIS scheme followed by modified national agricultural insurance

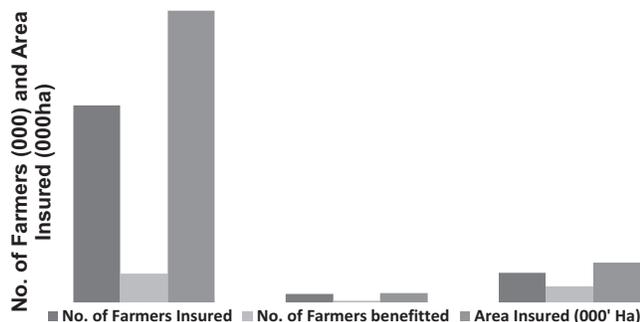


Figure 1: Comparison of number of farmers insured, farmers benefited and area covered in India

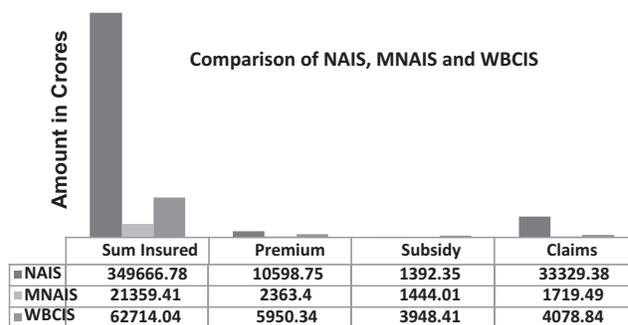


Figure 2: Comparison of sum insured premium, subsidy and claims in India

scheme and weather based crop insurance scheme.

### CONCLUSIONS

Agriculture production and farm incomes in India are frequently affected by natural disasters and man-made disasters which severely affect farmers through loss in production and farm income. To mitigate the risk in agriculture, government of India has introduced many crop insurance policies. The study indicates that the Maharashtra farmers largely benefited from national agriculture insurance scheme and Rajasthan farmers are largely benefited from MNAIS and WBCIS. The study indicates that highest (Figure 1) number of farmers insured and benefited from NAIS scheme followed by WBCIS. Among the insurance scheme, highest area under insurance covered by NAIS scheme at around 3.39 lakh ha followed by WBCIS scheme. The highest claims were seen in case of national agriculture insurance scheme

followed by WBCIS in India.

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## **Income Enhancement through Group Processing and Marketing of Natural Rubber: A Study of Rubber Producers' Society (RPS) in Kerala**

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### **ABSTRACT**

*The present study analyzed the role of Rubber Producers' Society in income enhancement of small holder rubber farmers. Formation of RPS has improved the economic and social status of smallholders. Members of RPS got benefits in terms of lesser cost of cultivation by 14 per cent compared to non-members. They incurred lesser processing cost and cost of production too. The group processing facilities ensure better quality produce and thereby higher price. The gross return was around 10 per cent higher for members compared to non members. Return per rupee of cost was 2.68 for members whereas it was only 2.08 for non-members. Major factors which influence gross return are tree population, labour, output and institutional membership.*

### **Keywords**

Income enhancement, Kerala, natural rubber, Rubber Producers' Society, small holdings

### **JEL Codes**

C83, D24, Q13

### **INTRODUCTION**

India is the fourth largest producer and second largest consumer of natural rubber in the world. Natural rubber enjoys an important place in the economy of Kerala. Among the major plantation crops, natural rubber occupies a pivotal role in terms of cropping area as well as by accounting for a major share in agricultural income of the state (Rajesh, 2015). The state of Kerala is the largest producer of natural rubber in the country by accounting for 87.6 per cent of the country's production during 2012-13 (Rubber Board, 2013). Rubber cultivation forms the back bone in the economic development of the state.

During the period 2004-05 to 2011-12 rubber replaced coconut as the principal income generating crop in the state of Kerala. There is a decline in the share of coconut in the total agriculture income of the state from 65 percent in 2004-05 to 44.73 percent in 2011-12. During the same period the share of rubber in the total agriculture income of the state increased from 28.65 per cent in 2004-05 to almost 50 percent in 2011-12. Increase in area of cultivation, higher production and productivity and increase in the price of rubber played an important role in the emergence of rubber as the principal income generating crop in the state (Rajesh, 2015).

Small holdings dominate the rubber plantation sector in the country by accounting for 90.5 per cent of the area and 93.5 per cent of the supply during 2012-13 (Rubber Board, 2013). The size of the small holdings sector is an indication of its decisive role in the development of the rubber plantation sector. Small holdings sector face several problems like prevalence of traditional and uneconomic methods of cultivation and resultant low productivity, absence of collective bargaining power and problems in processing and marketing (Anuja *et al.*, 2012). In order to cater to the need of these small holdings Rubber Board has promoted grass root level organizations at the village level called Rubber Producers' Societies (RPS).

RPS operate in small compact areas and the membership is in the range of 50-200 and is restricted to small rubber growers having rubber holding located within the operational area of concerned RPS. Administrative affairs are managed through an elected director board headed by a President. They function non-politically and on democratic lines.

RPS assists in transfer of technology to its members. They promote group approach for planting, productivity enhancement, availing Rubber Board grants, inputs etc.

They establish and run group processing and marketing facilities.

The group processing facilities established and managed by RPS help its members in up gradation of the quality of rubber by overcoming the problems faced by them in processing the latex. Most of the small holders cannot afford to start advanced and modern means of processing and thus results in production of poor quality rubber sheets which fetch them low price in the market. RPS undertakes common marketing of the processed rubber, grade-wise and at remunerative prices.

#### DATA AND METHODOLOGY

The study was undertaken in the Meenachil taluk of Kottayam district in Kerala in the year 2012-13. Kottayam district was purposively selected for the present study since it accounts for the largest area under rubber plantations in Kerala (Economic Review, 2013).

From Kottayam district a taluk namely, Meenachil taluk, was purposively selected which has the largest area under rubber plantations in the district and the Rubber Producers' Societies are more active here. From Meenachil taluk, two villages namely Kidangoor and Puliyanoor were selected purposively, which are having well-functioning RPSs. Small growers having an area of 0.5-2 hectares were selected at random from these two villages. Forty farmers who were members of the RPS were selected randomly. They sell their latex and process it through the Group Processing Center (GPC) of RPS. From the nearby area another sample of forty farmers who are non-members of the RPS was selected randomly. But they process the latex into sheet rubber and sell it individually. Thus, the total sample size for the study was eighty rubber farmers.

Necessary primary data were collected from rubber farmers through personal interview by using structured interview schedule in the month of February, 2013.

#### Cost of Cultivation of Rubber

##### Annual operational cost

Cost of cultivation of rubber has been estimated as per farm management cost principles and they are placed under variable and fixed cost categories in the case of rubber. The annual cost of maintaining rubber plantation was calculated separately for members and non-members.

**Variable costs:** The variable costs included labour costs for application of fertilizers, manures, plant protection chemicals, weeding and tapping and input costs of manures, fertilizers and plant protection chemicals. The interest on working capital at a rate of nine per cent was considered as a variable cost as it reflects the opportunity cost of operating capital. These costs were computed based on the prices prevailed during data collection.

**Fixed costs:** These included amortized cost of establishment, land revenue, depreciation of assets, rental value of owned land and the interest on fixed assets at 12 per cent rate of interest.

##### Yields and Returns

Yields and returns were calculated on per acre basis.

Average price received for rubber at the time of data collection was used to compute the income from plantations.

Gross return was obtained by multiplying the total product marketed, with price per unit of the product. Net returns were obtained by deducting total costs incurred from the gross returns calculated. Cost of production was calculated by dividing the total annual cost with the yield obtained. In calculating cost of production, processing cost was also included.

Factors influencing gross return from rubber cultivation

In order to examine the factors influencing the gross return from rubber cultivation, a multiple regression analysis was carried out. The linear form was chosen as a better fit based on the co-efficient of determination ( $R^2$ ) and the significance of regression co-efficients. The dependent variable included in the model was gross return per farm from rubber cultivation. The functional form of the model used in the study was

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6D \dots \dots \dots (1)$$

Where Y denotes the gross return measured in Rs. /farm.

a = Intercept

$b_1, b_2, b_3, b_4, b_5$  and  $b_6$  regression coefficients estimated

e = Stochastic error term

$X_i$  = Independent variables:

$X_1$  = Labour (Man days)

$X_2$  = Tree population (No.)

$X_3$  = Institutional support from Rubber Board (₹)

$X_4$  = Output (kg)

$X_5$  = Agrochemicals (₹)

D = Institutional membership (Non-member-0, Member-1)

#### RESULTS AND DISCUSSION

##### Cost of Cultivation of Rubber

The cost of cultivation of rubber in Kerala by two categories of farmers, namely RPS members and non-members pertaining to the year 2012-13 is given in Table 1.

As seen in the Table 1, total cost of cultivation of rubber in the case of RPS member was ₹62,541 and it was almost 14 per cent more in case of non-member. The major cost item was variable cost for both members (72 %) and non-members (77 %). Fixed costs were the next major costs. They constituted 28 per cent of the total cost for RPS members and 23 per cent for non-members.

Among different components of variable costs, labour cost was the prime cost constituting 56 per cent (₹34,988) and 62 per cent (₹44,900) of the total cost for members and non-members respectively. The labour cost was high for non-members due to the high tapping cost incurred by them since the tapper had to perform both tapping and processing operations. The major component of fixed costs was rental value of owned land which was 13 per cent and 10 per cent of the total cost for members and non-members respectively. The next major cost item was

amortized cost of establishment which constituted nine per cent and eight per cent for members and non-members respectively. The other costs constituted only a minor part of the total cost.

#### Yields and Returns of Rubber Cultivation

Yields and returns were worked out for members and non-members separately and the results are presented in Table 2.

The yield was calculated in terms of processed sheet rubber since it was the main form in which rubber was marketed. It is clear from the table that there was considerable difference in the yield realized by the members and non-members. It was about 800 kg/acre/year in case of members and 732 kg/acre/year for non-members. This may be due to the scientific cultivation practices, as prescribed by the Rubber Board, adopted by the RPS members.

There was a significant difference in the processing cost between two groups of farmers. Since the members of the RPS were processing their produce through the Group Processing Centre of the RPS they were incurring only a meagre amount towards the processing cost (₹144). Whereas, the non-members were individually processing their produce and their processing cost was higher (₹4,600).

Another major difference between RPS members and non-members was in the cost of production. The cost of production was high in the case of non-members (₹105/kg) than the members (₹78/kg) which in turn was due to the high variable cost and high processing cost incurred by the non-members.

The group processing facilities established and managed by RPS help its members in up gradation of the quality of rubber. Eighty per cent of the rubber processed

**Table 1: Cost of cultivation of rubber**

Particular	RPS Members (n <sub>1</sub> =40)		Non members (n <sub>2</sub> =40)	
	Amount (₹)	Per cent	Amount (₹)	Per cent
(₹/acre)				
<b>Variable costs</b>				
Manures and fertilizers	1,468	2.35	1,460	2.01
Plant protection chemicals	2,000	3.20	2,200	3.03
Rain guard	2,514	4.02	2,525	3.48
Maintenance of implements	480	0.77	500	0.69
Labour costs*	34,988	55.94	44,900	61.86
Interest on variable cost (9 per cent)	3,730	5.96	4,643	6.40
<b>Total variable cost</b>	<b>45,180</b>	<b>72.24</b>	<b>56,228</b>	<b>77.46</b>
<b>Fixed costs</b>				
<b>Amortized cost of establishment</b>	5,782	9.25	5,782	7.97
Rental value of owned land	8,389	13.41	7,582	10.45
Depreciation of assets	350	0.56	350	0.48
Land revenue	82	0.13	82	0.11
Interest on fixed assets (12 per cent)	2,758	4.41	2,565	3.53
<b>Total fixed cost</b>	<b>17,361</b>	<b>27.76</b>	<b>16,361</b>	<b>22.54</b>
<b>Total cost</b>	<b>62,541</b>	<b>100.00</b>	<b>72,589</b>	<b>100.00</b>

The wage rate is ₹500 per man day and ₹400 per woman day. Five per cent of the value of output is considered as the rental value of owned land as fixed by the CACP for commercial purpose crops.

\* Labour costs also include tapping cost

**Table 2: Yields and returns of rubber cultivation**

Items	RPS members (n <sub>1</sub> =40)	Non-members (n <sub>2</sub> =40)
Yield (Kg/acre)		
Main product	800	732
By product (scrap rubber)	225	200
Processing cost (₹/acre)	144	4600
Cost of production (₹/ Kg)	78	105
Price of sheet rubber (₹/kg)	176	173
Gross returns (₹/acre)	1,67,778	1,51,636
Net return over operational cost (₹/acre)	1,22,598	95,408
Net return over total cost (₹/acre)	1,05,237	79,047
Return per ₹ of cost	2.68	2.08

Cost of production includes processing cost

by RPS was of the highest quality (RSS 1 grade). Whereas, the non-members were mostly producing RSS 4 grade sheet, which has low market price compared to RSS 1 grade sheet. Achyuthankutty & Arunkumar (2009) also reported similar results that there is quality up gradation in group processing. Due to the quality up gradation and collective bargaining power RPS members realized better price compared to non-members. The members realized an average price of ₹176/kg whereas non-members ₹173/kg, thus showing a difference of ₹3/kg of sheet rubber.

The gross return was around 10 per cent high for members (₹167778) compared to non-members (₹151636) due to the fact that the output was high for members and they are realizing more price for their product. The net return over operational cost was high for members (₹122598) than non-members (₹95408) and the net return over total cost realized by the RPS members is ₹105237 while it is ₹79047 for non-members showing the advantageous position of the members. It was also found that return for every rupee investment was 2.68 and 2.08 for members and non-members respectively. The value is high for RPS members due to the high return and less cost of cultivation incurred by them. The result that there is increase in income for RPS members is in conformity with the findings of Rakshit & Nair (2009) and Anuja *et al.* (2012).

#### Factors Influencing the Gross Return from Rubber Cultivation

To examine the factors affecting the gross return of rubber farmers who are members of RPS vis-à-vis non-members a linear multiple regression model was fitted. The gross return per farm from rubber cultivation (₹) was taken as dependent variable and the independent variables were labour (man days), tree population (No.), institutional support from Rubber Board (₹), output (kg), cost of agrochemicals (₹) and institutional membership (Member-1, Non-member-0). The linear model reflects a good fit, which is indicated by the co-efficient of multiple determinations ( $R^2$ ), which is reasonably fair (0.87). The results are given in Table 3.

The population of trees in turn area has emerged as having a significant impact on the gross return. This is contrary to the scale neutrality. This has got an equity implication as majority of rubber farmers are small holders and further area expansion is not possible. The labour (man days) and output (kg) were also significant and positively associated with the gross returns. The increase in these variables was directly related to increase in returns. The dummy variable for the membership in RPS was also significant. It was positively associated with the returns. The value of the coefficient indicates that if a farmer is a member of RPS, the gross return increases by ₹5073. This may be due to the scientific cultivation practices adopted and the better price realized for product by the RPS

**Table 3: Factors influencing the gross return (₹) from rubber cultivation**

Variables	Coefficient	t-value
Intercept	10,914 <sup>***</sup>	2.64
Labour (Man days)	48 <sup>**</sup>	2.21
Tree population (No.)	91 <sup>**</sup>	2.09
Institutional support from Rubber Board (₹)	0.37 <sup>NS</sup>	0.91
Output (kg)	188 <sup>***</sup>	2.64
Cost of agrochemicals(₹)	8 <sup>NS</sup>	1.2
Institutional membership (NM-0, M-1)	5073 <sup>***</sup>	2.38
$R^2$	0.87	
F-ratio	60 <sup>***</sup>	
Adjusted $R^2$	0.84	

\*\*\* and \*\*significant at 1 and 5 per cent level.

NS: Non-significant

member. The use of agrochemicals and institutional support from Rubber Board were found insignificant.

#### CONCLUSIONS

The results of the study revealed that group processing and marketing through RPS realized better price for the product due to the high quality of the produce and collective bargaining power of the group which led to increase in income of the RPS members compared to non-members. The major factors having influence on gross income are output, institutional membership, labour and tree population. Technology transfer through the RPS by conducting seminars and training camps resulted in increased production of rubber by members of the RPS and this has positive influence on gross return. Institutional membership also has positive impact of gross return. So there should be measures from rubber board to increase the awareness among rubber farmers to take membership in RPS.

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## **Sustainable Groundwater Management in India-Challenges and Prospects**

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### **ABSTRACT**

*With growing scarcity of water and deteriorating quality, water resources management in India is becoming more challenging with the passage of time. However, the usable water resources of the country have been estimated as 1,123 billion cubic meters (BCM) per year. Out of which, the share of surface water and ground water is 690 BCM per year and 433 BCM per year respectively. Indian farmers are currently drawing more water than is sustainable, removing about 212 million megalitres from the ground each year to irrigate about 39 million hectares. However, India's groundwater resources are under threat. Intensive and unregulated pumping has caused a rapid and widespread decline in groundwater levels. Between 1950 and 2010, the number of tube wells drilled increased from one million to nearly 30 million, representing an unprecedented scale of development. There is no reason to believe that the growth in the number of these structures (wells and tube wells) have slowed down since then. Bringing groundwater withdrawal in line with its recharge and promoting a more sustainable pattern of groundwater usage and agricultural production require taking concurrent action on several fronts viz. estimation of ground water resources i.e. mapping aquifers effectively for a complete assessment of ground water resources, cropping pattern needed to be diversified by providing better price support for pulses and oilseeds, over extraction of ground water should be curtailed by regulating the use of electricity needed for its extraction. Different stakeholders- state governments, utilities, and farmers urgently need to address the groundwater management through a set of politically and financially feasible and socially acceptable alternatives.*

### **Keywords**

Aquifers, depletion, groundwater, sustainability, water demand

### **JEL Codes**

Q20, Q25, Q28

### **INTRODUCTION**

Water is a finite but widely present resource. It is a good solvent, which makes it highly vulnerable to pollution. Despite its wide presence, water availability and demand at many places have high degrees of mismatch: spatial and temporal. Many a times, it is a challenge to provide water of desired quantity and quality at a desired place. This is especially true for monsoon climates where 70-90 per cent of the annual rain falls in just 3-4 months. This leads to too much water and often floods in the wet season, and too little water and often droughts in the dry season. At times, enough water may be available but the quality may be so poor that it is of no use without treatment.

According to the United Nations Educational, Scientific and Cultural Organisation (UNESCO) estimates, the total volume of water on earth is about 1.4 billion km<sup>3</sup>, which is enough to cover the earth with a layer

of 3 km depth. However, World's oceans cover about three-fourths of earth's surface while the fresh water constitutes a very small proportion of this enormous quantity available on the earth. It is only about 35 million km<sup>3</sup> or 2.5percent of the total volume. Of these, about 24 million km<sup>3</sup> or 68.9per cent is in the form of ice and permanent snow cover in mountainous regions, the Antarctic and Arctic regions and another 29.9 per cent is present as ground water (shallow and deep groundwater basins up to 2,000 metres). The rest 0.3per cent is available in lakes, rivers and 0.9 per cent in soil moisture, swamp water and permafrost atmosphere.

Growing population coupled with sustainable developmental efforts has an increasing stress on water resources. The uneven distribution over time and space of water resources and their modification through human use and abuse are sources of water crises in many parts of the world. All these result in intensifying the pressure on

water resources leading to tensions, conflict among users and excessive pressure on the environment. These demand the planners and policy makers for a proper management of water resources.

Sustainable water management in India poses numerous challenges viz. bridging the increasing gap between demand and supply, providing enough water for production of food, balancing the uses between competing demands, meeting the growing demands of big cities, treatment of wastewater, sharing of water with the neighbouring countries and among the co-basin states, etc. With growing scarcity of water and deteriorating quality, water resources management in India is becoming more challenging with the passage of time. In the background of this, the present study has been undertaken (1) to examine the status of water resources of the country (2) To analyse the growth of groundwater irrigation and consequences of its overuse. (3) To suggest ways for promoting a more sustainable pattern of groundwater usage.

#### DATA SOURCES

To meet the stipulated objectives of the study, Secondary data were collected from various published sources viz. Agricultural statistics at a glance, various reports of Central Groundwater Board, Groundwater Year Book etc.

#### RESULTS AND DISCUSSION

##### Status of Water Resources in India

###### Inland water resources

Inland Water resources of the country are classified as: rivers and canals; reservoirs; tanks, lakes & ponds; lakes and derelict water bodies; and brackish water. The area of water bodies at all-India level has been presented in Table 1. Total water bodies other than rivers and canals cover an area of about 7.3 Mha. Among these water bodies, 'reservoirs' have maximum area (2.93 Mha) followed by 'tanks, lakes and ponds' (2.43 Mha). The total area of inland water resources (other than rivers and canals) is unevenly distributed over the States.

###### Rainfall

The annual precipitation including snowfall, which is the main source of water in the country, is estimated to be of the order of 4000 billion cubic meters (BCM). A summary of rainfall in the country has been given in Table 2. Accordingly there is no specific trend of rainfall. In 2013, the total volume of rainfall was 4085 BCM as against 3467 BCM recorded during the previous calendar

**Table1: Inland water resources of India**

Rivers and canals (length in km)	195095
Other water bodies (area in Mha)	
Reservoirs	2.93
Tanks & Ponds	2.43
Flood plain lakes & derelict water bodies	0.80
Brackish water	1.15
Total	7.31

Source: Handbook on Fisheries Statistics- 2014, Department of Animal Husbandry, Dairying & Fisheries, M/o Agriculture

year registering an increase of about 18 per cent.

###### Ground water in India

Ground water is the water that seeps through rocks and soil and is stored below the ground. The rocks in which ground water is stored are called aquifers. Aquifers are typically made up of gravel, sand, sandstone or limestone. Water moves through these rocks because they have large connected spaces that make them permeable. The area where water fills the aquifer is called the saturated zone. The depth from the surface at which ground water is found is called the water table. The water table can be as shallow as a foot below the ground or it can be a few hundred meters deep. Heavy rains can cause the water table to rise and conversely, continuous extraction of ground water can cause the level to fall.

The underground (hydrogeological) setting of ground water defines the potential of this resource and its vulnerability to irreversible degradation. This setting in India can be divided into following categories, which are described below:

###### Hard-rock aquifers of peninsular India

These aquifers represent around 65 per cent of India's overall aquifer surface area. Most of them are found in central peninsular India, where land is typically underlain by hard-rock formations. These rocks give rise to a complex and extensive low-storage aquifer system, where in the water level tends to drop very rapidly once the water table falls by more than 2-6 meters. Additionally, these aquifers have poor permeability which limits their recharge through rainfall. This implies that water in these aquifers is non-replenish able and will eventually dry out due to continuous usage.

###### Alluvial aquifers of the Indo-Gangetic plains

These aquifers, found in the Gangetic and Indus plains in Northern India have significant storage spaces, and

**Table 2: Volume of rainfall in the country**

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Total rainfall (mm)	1234	1086	1215	1161	1181	1117	954	1213	1116	1024	1243
Total volume of rainfall (BCM)	4057	3570	3996	3819	3882	3674	3136	3989	3669	3467	4085

Source: Indian Meteorological Department (IMD), M/o Science & Technology

hence are a valuable source of freshwater supply. However, due to excessive ground water extraction and low recharge rates, these aquifers are at the risk of irreversible overexploitation.

**Ground water availability**

As of April 2015, the water resource potential or annual water availability of the country in terms of natural runoff (flow) in rivers is about 1,869 Billion Cubic Meters (BCM) per year. However, the usable water resources of the country have been estimated as 1,123 BCM per year. This is due to constraints of topography and uneven distribution of the resource in various river basins, which makes it difficult to extract the entire available 1,869 BCM per year. Out of the 1,123 BCM per year, the share of surface water and ground water is 690 BCM per year and 433 BCM per year respectively (Table 3). Setting aside 35 BCM for natural discharge, the net annual ground water availability for the entire country is 398 BCM (Anonymous, 2015,). The overall contribution of rainfall to the country's annual ground water resource is 68 per cent and the share of other resources, such as canal seepage, return flow from irrigation, recharge from tanks, ponds and water conservation structures taken together is 32 per cent. Due to the increasing population in the country, the national per capita annual availability of water has reduced from 1,816 cubic metres in 2001 to 1,544 cubic metre in 2011. This is a reduction of 15 per cent.

**Table 3: Statistics regarding water availability in India**

Parameter	Unit (Billion Cubic Meter/Year)
Annual water availability	1,869
Usable water	1,123
Surface water	690
Ground water	433

Source: Anonymous, 2015b

Ground water resources in the country are assessed at different scales within districts, such as blocks/mandals/talukas/watersheds. Ground water development is a ratio of the annual ground water extraction to the net annual

ground water availability. It indicates the quantity of ground water available for use. Table 4 compares the level of ground water development in the country over the past two decades.

The level of ground water development is very high in the states of Delhi, Haryana, Punjab and Rajasthan, where ground water development is more than 100 per cent. This implies that in these states, the annual ground water consumption is more than annual ground water recharge. In the states of Himachal Pradesh, Tamil Nadu and Uttar Pradesh and the Union Territory of Puducherry, the level of ground water development is 70 percent and above. In rest of the states, the level of ground water development is below 70 percent. Over the years, usage of ground water has increased in areas where the resource was readily available. This has resulted in an increase in overall ground water development from 58per cent in 2004 to 62per cent in 2011(Anonymous, 2014).

**Growth of groundwater irrigation**

Globally, about 40 per cent of irrigation water is supplied from groundwater, and India is the world's largest user (Aeschbach-Hertig and Gleeson, 2012). India has extensive groundwater resources and India abstracts about 245 BCM of groundwater per year, which represents about 25 per cent of the total global groundwater abstraction. Groundwater use helped to spur the Green revolution and currently provides 65 per cent of irrigation. Due primarily to access to availability of irrigation, India has been able to achieve food security. The food grain production has increased from 108 million tonnes in 1970 to about 265 million tonnes in 2014 (Anonymous, 2015). Over 80 per cent of the rural and urban domestic water supplies in India are served by groundwater. It contributes to the base flow in rivers and wetlands and supports terrestrial vegetation. In arid and semi-arid regions, it is often the sole water supply source. Therefore, groundwater plays a crucial role in the socioeconomic development of the country. However, India's groundwater resources are under threat. Intensive and unregulated pumping has caused a rapid and

**Table 4: Comparative status of level of ground water development in India in the past 20 years**

Level of ground water development (Per cent)	Explanation	Per cent of districts in 1995	Per cent of districts in 2004	Per cent of districts in 2009	Per cent of districts in 2011
0-70 (Safe)	Areas which have ground water potential for development	92	73	72	71
70-90 (Semi-critical)	Areas where cautious ground water development is recommended	4	9	10	10
90-100 (Critical)	Areas which need intensive monitoring and evaluation for ground water development	1	4	4	4
>100 (Over exploited)	Areas where future ground water development is linked with water conservation measures	3	14	14	15

Source: Anonymous, 2014

widespread decline in groundwater levels. Between 1950 and 2010, the number of tube wells drilled increased from one million to nearly 30 million, representing an unprecedented scale of development. This explosive groundwater use – the so-called 'silent revolution' – has led to extensive overdraft in several rural areas, including in the “bread basket” states of the North and the Northeast, as well as in major urban settings. Falling water tables have, in turn, led to groundwater yield reductions, pump failure in rural water-supply wells, unreliable urban water supply, salinization, land subsidence and drying of wetlands, all of which have direct consequences for the economies, livelihoods and societies that are dependent on groundwater resources. A recent assessment of selected districts in India shows that poverty rates are 9-10 percent higher in areas where groundwater tables are below 8 meters (Sekri, 2014).

India currently uses 26 million groundwater pumps for irrigation. Diesel generators are commonly used when grid power is unavailable, a not uncommon occurrence. And the power used for pumping irrigation water is also one of the largest strains on the Indian power grid. Pumping water is critical for Indian agriculture, which otherwise relies on seasonal rain. It's also very contentious-Indian farmers are currently drawing more water than is sustainable, removing about 212 million mega litres from the ground each year to irrigate about 39 million hectares. Around 1960, groundwater irrigation started developing at an explosive rate. The Green Revolution was a turning point in India's agricultural development, providing great benefits to those who could adopt new seeds and fertilizers, for which water control was an essential prerequisite. Irrigated agriculture provides employment, incomes and livelihood to millions of farmers and agricultural labour in the country (Bhatia 2007) and has contributed a great deal to reduce poverty in the countryside (Malik & Rathore, 2007).Electricity use in pumping groundwater constitutes more than one-fifth of the total electricity consumption in several states. Thus, net area irrigated by private wells and tubewells is more than 2.3 times of the net irrigated area by canals. Net Irrigated Area (NIA) under wells and tubewells as per cent of total net area irrigated is greater than 60 per cent in

Bihar, Gujarat, Punjab, Madhya Pradesh, Uttar Pradesh, Maharashtra and Rajasthan. In Haryana, Andhra Pradesh, Karnataka and Tamil Nadu, the share of net irrigated area by tubewells is between 50 and 60 per cent, while in Orissa, Chhattisgarh, Kerala and West Bengal the share is less than 50 per cent (Anonymous, 2014).

As irrigation accounts the maximum utilisation of water, it is pertinent to look at the irrigation statistics vis-à-vis availability of land in the country and its use especially in relation to water use. The relevant data available from Ministry of Agriculture at national level has been presented in Table 5. Over this period the data show that net sown area and gross sown area are undulating while total cultivable area has a declining trend but forest area, gross irrigated area, net irrigated area have a slow increasing trend. However, it indicates only about 45 per cent of area cropped in the country is irrigated during the period 2006-07 to 2010-11 thereby indicating that 55 per cent of the sown area-gross or net-doesn't have irrigation facility.

**Irrigated area under principal crops**

For having an idea about the quantum of water used for irrigation it is important to know irrigated area under different crops as requirement of water varies from crop to crop. The gross irrigated area for a few selected crops has been presented in the following Table 6. It shows that gross irrigated area during 2011-12 was 91.5 Mha of which food-grain crops contributed about 67.15per cent.

Among the cereals, it is observed that irrigated area under rice varied between 24.2 million hectares (Mha) to26.6 Mha during the period 2000-01 to 2011- 12. The irrigated area under wheat remained between 25.7 Mha to 28.0 Mha during the same period.

**Sources of irrigation and area irrigated**

The main sources of irrigation in the country are canals, tanks and wells including tube-wells. Analysing the data relating to net area irrigated by source for the year 2011-12, it is observed that the major source of irrigation is ground water. It was found (Table 7) that wells (considering all types of wells viz. dug well, shallow tube-well, deep tube-well) provided about 61.57 per cent irrigation followed by canals with 24.54 per cent at all-India level during 2011-12.

**Table 5: Land use and irrigation statistics at all India level**

Year	Geographical area	Forest area	Net sown area (NSA)	Total cultivable area (TCA)	Gross sown area (GSA)	Gross irrigated area (GIA)	Net irrigated area (NIA)
2000-01	328726	69843	141336	183455	185340	76187	55205
2001-02	328726	69720	140734	183552	188014	78371	56936
2005-06	328726	69994	141162	182686	192737	84280	60837
2008-09	328726	69978	141899	182459	195314	88896	63638
2010-11	328726	70009	141559	182018	197323	88630	63598
2011-12	328726	70015	140801	181983	195246	91530	65263

Source: Anonymous, 2015

**Table 6: Gross irrigated area for selected crops in India**

Crop / Year	('000 ha)										
	1950-51	1960-61	1970-71	1980-81	1990-91	2000-01	2007-08	2008-09	2009-10	2010-11	2011-12
Wheat	3402	4233	9924	15553	19511	22798	26094	25694	26195	27472	27964
Rice	9844	12523	14339	16364	19470	24337	25218	26584	24221	25371	25607
Rapeseed & Mustard	N.A.	138	356	990	3076	2759	4203	4448	3846	3891	4043
Food grains	18317	22065	30117	3785	44866	53609	59512	60415	58122	60708	61466
Cotton	465	967	1358	2115	2487	2766	3534	3362	3590	3699	4373
Total gross irrigated area	22563	27980	38195	49775	63204	76187	88058	88896	85085	88630	91530

Source: Anonymous, 2015

**Table 7: Source-wise net irrigated area in India**

Year	('000 ha)				
	Canal	Tank	Wells	Other sources	Total (All sources)
2000-01	16012 (29.00)	2466 (4.47)	33818 (61.25)	2909 (5.28)	55205 (100.00)
2004-05	14766 (24.93)	1734 (2.92)	35191 (59.42)	7538 (12.72)	59229 (100.00)
2007-08	16748 (26.50)	1973 (3.13)	38361 (60.71)	6107 (9.66)	63189 (100.00)
2010-11	15667 (24.63)	2004 (3.15)	39061 (61.40)	6887 (10.82)	63619 (100.00)
2011-12	16017 (24.54)	1937 (2.97)	40187 (61.57)	7123 (10.91)	65264 (100.00)

Figures in parentheses show the percentages to their respective totals  
Source: Anonymous, 2015

### Water demand in India

The requirement of fresh water both for irrigation and other uses is growing continuously. The requirement of water for various sectors has been assessed by the National Commission on Integrated Water Resources Development (NCIWRD) in the year 2000. This requirement is based on the assumption that irrigation efficiency will increase to 60 per cent from the current

level of 35-40 per cent. The following Table 8 indicates the projected water demands in India for different sectors.

The food requirement of the growing population will be about 450 million tons in 2050 as against the present highest food grain production of around 260 million tons. Two-third of this is obtained from irrigated food grain production areas. Thus, irrigation water requirements of the country are likely to exert tremendous pressure on our water resources in the future.

### Unchecked extraction, overuse and deteriorating groundwater quality

Out of 6607 numbers of assessed administrative units (Blocks/ Taluks/ Mandals/ Districts), 1071 units are categorized as over-exploited, 217 units are critical, 697 units are semi-critical, and 4530 units are safe. Apart from these, there are 92 assessment units which are completely saline (Table 9). Number of over-exploited and critical assessment units are significantly higher (more than 15% of the total assessed units) in Delhi, Haryana, Himachal Pradesh, Karnataka, Punjab, Rajasthan and Tamil Nadu, Uttar Pradesh and also the UTs of Daman & Diu and Puducherry.

A perusal of the geographical distribution of the over exploited blocks indicate that the over-exploited blocks are concentrated in the North Western, Western and

**Table 8: Projected water demand in India (By different use)**

Sector	Water demand in cubic km (or BCM)					
	Standing sub-committee of MoWR *			NCIWRD**		
	2010	2025	2050	2010	2025	2050
Irrigation	688	910	1072	557	611	807
Drinking water	56	73	102	43	62	111
Industry	12	23	63	37	67	81
Energy	5	15	130	19	33	70
Others	52	72	80	54	70	111
Total	813	1093	1447	710	843	1180

Source: Standing Committee for Assessment of Availability and Requirement of Water –

\* Ministry of Water Resources, River Development and Ganga rejuvenation (2000)

\*\* National Commission on Integrated Water Resources Development (NCIWRD) (1999)

**Table 9: Categorization of assessment units based on stage of groundwater development**

Stage of development	Number of assessment units	Per cent
Overexploited	1071	16
Critical	217	3
Semi-Critical	697	11
Safe	4530	69
Saline	92	1
Total	6607	100

Source: Anonymous, 2014

Southern Peninsular part of the country. While the primary reason for over-exploitation in the North Western part i.e. Punjab and Haryana is indiscriminate extraction of ground water mainly for irrigation purpose, in the Western part of the country viz. Rajasthan and Gujarat, over-exploitation is caused by arid climate resulting in scanty and irregular rainfall and consequent low recharge. In the southern part of the country i.e. Karnataka, and Tamil Nadu, large number of over-exploited blocks are caused because of hard rock terrain which permits less recharge and thus result in water stressed conditions.

As a result of unchecked extraction of groundwater, the groundwater tables have been falling in many parts of the country. An analysis of the pre-monsoon level of depth to water table for 2013 in the different regions of the country suggest that in major parts of North-Western states, depth to water level generally ranges from 10-40 m below ground level (bgl). In the western parts of the country deeper water level is recorded in the depth range of 20-40 m bgl. In North Gujarat, parts of Haryana and western Rajasthan water level more than 40 m bgl is recorded. Along the eastern & western coast water level is generally less than 10 m. Central part of West Bengal state recorded water level in the range of 5-20 m bgl. In north central India water level generally varies between 10-20 m bgl, except in isolated pockets where water level less than 10 m bgl has been observed. The peninsular part of country generally recorded a water level in the range of 5 to 20 m bgl depth range (Anonymous, 2014).

Deteriorating groundwater quality is also a significant and growing problem. Pollution from poor sanitation, mining, industry and agro-chemicals (pesticides and fertilizers) together with naturally occurring contaminants (arsenic, fluoride and iron) reduce 'effective' groundwater supply further. Ground water contamination is the presence of certain pollutants in ground water that are in excess of the limits prescribed for drinking water. The commonly observed contaminants include arsenic, fluoride, nitrate and iron, which are geogenic in nature. Other contaminants include bacteria, phosphates and heavy metals which are a result of human activities including domestic sewage, agricultural practices and industrial effluents. The sources of contamination include pollution by landfills, septic tanks,

leaky underground gas tanks, and from overuse of fertilizers and pesticides. It has been pointed out that nearly 60 per cent of all districts in the country have issues related to either availability of ground water, or quality of ground water, or both. Table 10 shows the number of states and districts affected by geogenic contaminants as on July 2014.

**Table 10: States and districts affected by geogenic contamination in groundwater**

Geogenic contaminants	Number of affected states	Number of affected districts
Arsenic	10	68
Fluoride	20	276
Nitrate	21	387
Iron	24	297

Source: Anonymous (2015a)

The Committee on Estimates 2014-15 that reviewed the occurrence of high arsenic content in groundwater observed that 68 districts in 10 states are affected by high arsenic contamination in groundwater. These states are Haryana, Punjab, Uttar Pradesh, Bihar, Jharkhand, Chhattisgarh, West Bengal, Assam, Manipur and Karnataka.

**Sustainable Management of Groundwater:** Bringing groundwater withdrawal in line with its recharge and promoting a more sustainable pattern of groundwater usage and agricultural production require taking concurrent action on several fronts;

**Estimation of ground water resources**

The current assessment methodology uses 15,640 observation wells for over 30 million ground water structures, which makes the available data indicative and not representative. It has been noted that a clearer understanding of the state of aquifers in India will help in their management and governance at the local level. The Planning Commission Working Group on Sustainable Ground Water Management made the following recommendations to improve assessment:

- Strengthening the database management by central and state governments,
- Adopting alternative techniques for recharge assessment where the estimates do not match the situation on the field
- Mapping aquifers effectively for a complete assessment of ground water resources.

**Agricultural crop pricing and water intensive crops**

In the last four decades, roughly 84 percent of the total addition to the net irrigated area has come through ground water. The primary cause of over-exploitation has been the rising demand for ground water from agriculture. Further, decisions such as cropping pattern and cropping intensity are taken independent of the ground water availability in most areas. Even though Minimum Support Prices (MSPs) are currently announced for 23 crops, the effective price support is for wheat and rice. This creates highly skewed incentive structures in favour

of wheat and paddy, which are water intensive crops and depend heavily on ground water for their growth. Cropping pattern needed to be diversified by providing better price support for pulses and oilseeds. The perusal of Table 11 shows the average amount of water (in cubicmeters/tonne) needed to grow different crops. It indicates India's efficiency in the usage of water for agriculture as compared to other countries. As can be seen, India uses almost twice the amount of water to grow crops as compared to China and United States.

**Table 11: Water use for crop production in different countries (in cubic metres/tonne)**

Crops and crop products	Average amount of water needed to grow crops in			
	Brazil	India	China	United States
Rice	3,082	2800	1321	1275
Sugarcane	155	159	117	103
Wheat	1,616	1654	690	849
Cotton	2,777	8264	1419	2535

*Source: Anonymous (2015b)*

#### **Energy subsidies and ground water extraction**

The practice of providing power subsidies for agriculture has played a major role in the decline of water levels in India. Since power is a main component of the cost of ground water extraction, the availability of cheap/subsidised power in many states adds to the greater extraction of this resource. Over extraction of ground water should be curtailed by regulating the use of electricity needed for its extraction.

#### **Quality of ground water**

The Comptroller and Auditor General (CAG) of India in its Performance Audit of Water Pollution in India, 2011-12 observed that despite increasing pollution of ground water sources and presence of contaminants like arsenic, nitrate, fluoride, salinity, etc., no programme at the central or state level is being implemented for control of pollution and restoration of groundwater. The CAG has made the recommendations with regard to the prevention and control of pollution of groundwater: (i) the Ministry of Environment, Forests, and Climate Change needs to establish enforceable water quality standards for lakes, rivers and ground water to help protect ecosystem and human health, (ii) penalties need to be levied for violations of water quality standards, and (iii) states need to take measures for source control of pollutants through sewage and agriculture runoff entering water bodies in projects for conservation and restoration of lakes.

#### **Local management of ground water**

The Planning Commission recommended that local planners take the following steps while planning for ground water management:

- Identification of ground water recharge areas,
- Maintaining ground water balance at the level of the village or the watershed.

- Creating regulatory options at the community level such as panchayat. Examples of activities that could be regulated at the local level include drilling depth, distance between wells, cropping patterns to ensure sustainability of aquifers and participatory ground water management.

#### **CONCLUSIONS**

Groundwater is an important component of the global water cycle, and a vital resource to sustain agricultural, industrial, and domestic activities in many parts of the world, particularly in the most populous countries (e.g., China and India) or arid regions lacking adequate alternative resources of fresh water (e.g., Middle East and North Africa). Excessive ground water extractions can lead to regional water resource scarcity, and pose significant impacts on the ecosystem and economic and social developments. Groundwater-based farming currently is and is likely to continue to be not only the main source of food grain production but also a powerful engine of India's rural economic growth with very strong impacts both for the rural as well as urban economy. It is however clear that the way in which the groundwater is currently being managed, these benefits of groundwater could be short lived unless immediate steps are initiated to put groundwater management on more sustainable footing. Different stakeholders- state governments, utilities, and farmers urgently need to address the groundwater management through a set of politically and financially feasible and socially acceptable alternatives.

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## Strategy of Minimizing the Cost of Cultivation *vis-à-vis* Boosting Farm Income of Small-Holder Maize Farmers in Niger State of Nigeria Using Efficiency Measurement System (EMS)

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### ABSTRACT

This research empirically devised a mechanism of reducing the cost of cultivation *vis-à-vis* boosting farm income of small-holder maize producers in Niger state of Nigeria using a non parametric model called data envelopment analysis (DEA). The study made use of farm survey data obtained from 60 active maize producers viz. a multi-stage sampling design. Production information *vis-à-vis* prices of inputs and output were elicited from the farmers' on fortnight basis during the year 2016 cropping season using structured questionnaire coupled with interview schedule. In DEA models the farmers that produce their level of output with the least cost combination incurred on input serve as bench marks against which the input cost inefficiency of all other farmers can be measured. The mean values of technical, pure technical and scale efficiencies of farmers were found to be 0.836, 0.887 and 0.943, respectively. It was observed that the cost of cultivation incurred was N24159.09, and can be reduced by about 32.81 per cent if the farmers follow the input costs packages recommended by the DEA. Furthermore, by adopting these recommendations the economic indices of the inefficient farmers' viz. gross margin, net farm income, benefit-cost ratio, ROI, RORCI, TFP would improve by 12.26, 14.18, 48.49, 64.48, 67.53, and 48.94 per cent, respectively. Based on these findings, the study recommends that efficient financial resource management and production management practices should be adopted by the inefficient farmers' in the study area in order to achieve optimum economic efficiency in maize farming.

### Keywords

Cost efficiency, cost saving, DEA, Nigeria, optimization, small-holder maize

### JEL Codes

C01, C14, C15, Q12

### INTRODUCTION

Neoclassical literature of production economics from Samuelson's innovative foundation of economic analysis to the present day, treat producers as successful optimizers. They minimize the cost of producing whatever output they choose to produce, given the technology in place and the input prices they face. However, casual empiricism and the business press both make persuasive cases for the argument that, although producers may indeed attempt to optimize, they do not always succeed. The anecdotal evidence cited, and much other empirical evidence as well, suggests that not all producers are always so successful in solving their

optimization problems. Consequently not all producers succeed in minimizing the cost required to produce the output they choose to produce. In addition, even if they are technically efficient, not all farmers succeed in allocating their inputs in a cost-effective manner, given the input prices they face, and these inputs misallocation contributes further to their failure to minimize the expenditure required to produce the output they choose to produce. In light of the evident failure of (at least some) farmers to optimize, it is desirable to recast the analysis of production, cost, and profit away from the traditional function towards frontiers. Furthermore, it is imperative to adopt modified econometric approach which allows

farmers to be relatively more successful than others, so as to provide the basis for the subsequent investigation into the determinants of variation in the efficiency with which farmers pursue their objectives. Therefore, the present research was borne out based on the aforementioned facts, with the aim of providing an insight empirical feasible way forward for farmers particularly in Africa who most times fall victims of inconsistent policies.

**RESEARCH METHODOLOGY**

Niger state, an agrarian state which has being in the forefront in food crop production is located in north-central part of Nigeria, stretches between latitudes 8°20'N and 11°30'N of equator and longitude 3°30'E and 7°20'E of the Greenwich Meridian. The present study used cross-sectional data elicited from 60 maize farmers' viz. multi-stage sampling design. Stage wise sampling design were: purposive selection of one agricultural zone out of the three agricultural zones, namely Kuta being the leading zone in maize production in the state; random selection of three local government areas, namely Paikoro, Shiroro and Tafa; random selection of two farming communities from each selected LGA; and, random selection of ten (10) active sole maize crop farmers from each selected farming communities, thus, given a total sampling size of 60 respondents. Structured questionnaire coupled with interview schedule were used to collect data on fortnight basis from the farmers during the 2016 cropping season. Analytical techniques used are Data envelopment analysis, pseudo-profit techniques and descriptive statistics.

**Empirical Models**

Data Envelopment Analysis (DEA): Method of comparing relative productive efficiencies of individual economic units has attracted substantial interest from Agricultural economists for more than half a century. Since the innovative study by Farrell (1957), linear programming methods had been competing with regression estimates for production functions. The LP methods rationalize observed input-output combinations by providing a piece-wise linear frontier for the most efficient economic units, with other less efficient units falling within the envelope that are defined by this empirical frontier: DEA envelops the data and hence the name. Data envelopment analysis was initially developed by Charnes et al. (1978), from the earlier work of Farrell (1957); Farrell & Fieldhouse (1962), a sophisticated management tool to help farmers in their input use decision, because it offers a flexible approach with considerable scope for the use of diverse data. When agricultural economists are more familiar with its features, DEA based indicators may become as common as those of the production function analysis. Below are the relevant concept models:

**The CCR Efficiency Model**

As Charnes et al. (1978) reported the LP model deployed to generate the CCR efficiency factors of the DMUs considered is as follows.

The CCR model (to be solved for each DMU<sub>k0</sub>):

$$Max \theta_{CCR} (k_0) = \sum_{j=0}^n U_j Y_{jk} \quad 0 \dots\dots\dots(1)$$

Subject to:  $\sum_{j=0}^n U_j Y_{jk} 0$

$$\sum_{i=0}^m \theta_i X_{ik_0} = 1 \dots\dots\dots(2)$$

$$- \sum_{i=0}^m \theta_i X_{ik_0} + \sum_{j=1}^n U_j Y_{jk} \leq 0 \quad U_j \geq 0, \theta_j \geq 0 \dots\dots(3)$$

$$k = 1, \dots\dots\dots, k \quad j = 1, \dots\dots\dots, n \quad i = 1, \dots\dots\dots, m$$

Where  $U_j$  is the weight for output  $j$ ;  $\theta_i$  is the weight for input  $i$ ;  $m$  the number of inputs;  $n$  the number of outputs;  $K$  the number of DMU<sub>s</sub>;  $Y_{jk}$  the amount of output  $j$  of DMU<sub>k</sub>; and  $x_{ik}$  the amount of input  $I$  of DMU<sub>k</sub>.

**The BCC Efficiency Model**

Banker et al. (1984) reported the LP model deployed to generate BCC efficiency factors of the DMUs is as follows: The BCC model (to be solved for each DMU<sub>k0</sub>):

$$Max \theta_{BCC} (k_0) = \sum_{j=0}^n U_j Y_{jk} - U (k_0) \dots\dots\dots(4)$$

Subject to:

$$\sum_{i=0}^m \theta_i X_{ik_0} = 1 \dots\dots\dots(5)$$

$$- \sum_{i=0}^m \theta_i X_{ik_0} + \sum_{j=1}^n U_j Y_{jk} - U (k_0) \leq 0 \quad U_j \geq 0, \theta_j \geq 0 \quad (6)$$

$$k = 1, \dots\dots\dots, k \quad j = 1, \dots\dots\dots, n \quad i = 1, \dots\dots\dots, m$$

$$SE = \theta_{CCR} / \theta_{BCC} \dots\dots\dots(7)$$

Where,  $\theta_{CCR}$  and  $\theta_{BCC}$  are the CCR and BCC scores of a DMU, respectively. By definition, SE cannot be greater than one. In the analysis of efficient and inefficient DMUs, the cost saving target ratio (CSTR) was used to specify the inefficiency level of cost incurred for the DMUs under consideration. This formula was modeled from the ESTR formula developed and is given as follow:

$$CSTR (per\ cent) = \frac{Cost\ saving\ target}{Actual\ input\ cost} \times 100$$

Where, cost saving target is the total amount of input cost that could be saved without decreasing output level. CSTR represents each inefficiency level of cost wasted, and the value ranges between zero and unity. A higher CSTR implies higher input cost inefficiency, and thus, a higher cost saving amount.

**Coefficient of multiple determination (R<sup>2</sup>)**

$$R^2 = \frac{1 - \sum_{i=1}^n (A_i - P_i)^2}{\sum_{i=1}^n A_i^2}$$

Where,  $R^2$  = coefficient of multiple determination;  $A_i$  = actual input cost of  $i^{th}$  farmer; and,  $P_i$  = Projected input cost of  $i^{th}$  farmer.

**Kendall's coefficient of concordance (W)**

$$W = \frac{12 \sum d_2}{m^2(n)(n^2-1)} \quad \chi^2 = m (n-1) W$$

Where;  $d^2$  = sum of error square;  $m$  = attribute/variable;

n=No. of observation;  $\chi^2$ =Chi<sup>2</sup>. The preliminary costs and returns to maize production are presented in Table 1.

**Table 1: Preliminary costs and returns to maize production per hectare**

Items	Quantity	Unit price (₹)	Cost (₹)	Per cent
<b>Inputs</b>				
Family labour	12.54 manday	500	6269.73	26
Paid labour	9.567 manday	500	4783.33	20
Seeds	2.90 kg	600	1739.00	7
Fertilizer	50.07 kg	140	7010.11	29
Biocides	2.28 ltr	1100	2507.69	10
Depreciation	-	-	1849.22	8
<b>Total cost</b>			<b>24159.09</b>	<b>100</b>
<b>Outputs</b>				
Yield	667.19kg	120	80062.33	
<b>Total revenue</b>			<b>80062.33</b>	
<b>Gross margin</b>			<b>57752.33</b>	
<b>Net profit (π)</b>			<b>55903.25</b>	

Source: Field survey, 2016

## RESULTS AND DISCUSSION

### Measuring the efficiency of farmers

Distributional results of farmers based on the efficiency score obtained using CCR and BCC DEA models are shown in Table 2. Evidently, approximately 23.3 percent (14 farmers) and 51.7 percent (31 farmers) were identified as relative efficient farmers under constant and variable returns to scale assumptions, respectively, while approximately 76.7 percent (46 farmers) and 48.3 percent (29 farmers) with respect to CRS and VRS were inefficient as their efficiency scores were below one. An efficiency score of less than 1 for CRS implies that a DMU did not apply the right techniques properly, while an efficiency score of less than 1 for VRS indicates that a DMU is inefficient in cost allocation (resources wastage). Moreover, among efficient farmers only 14 DMUs were identified to be fully efficient in both technical and pure technical efficiency scores, indicating they were globally efficient and operated at the most productive scale size; the remaining 17 pure technically efficient DMUs were locally efficient, and this was due to disadvantageous conditions of scale-size. Also, among inefficient farmers, 24 DMUs and 12 DMUs with respect to technical and pure technical efficiency scores had their efficiency scores between 0.80 - 0.99. This means that these DMUs should be able to obtain the same output level using their efficiency score at their current level of input costs incurred when compared to their benchmark which is

**Table 2: Deciles frequency distribution of efficiency score of maize farmers**

Efficiency level	TE	PTE	SE
0.499	1	19	0
0.500-0.599	3	2	0
0.600-0.699	9	8	0
0.700-0.799	9	6	1
0.800-0.899	11	5	12
0.900-0.999	13	7	32
1.00	14	31	15
<b>Total</b>	<b>60</b>	<b>60</b>	<b>60</b>
<b>Min</b>	<b>0.836</b>	<b>0.887</b>	<b>0.943</b>
<b>Max</b>	<b>0.485</b>	<b>0.429</b>	<b>0.707</b>
<b>Mode</b>	<b>1</b>	<b>1</b>	<b>1</b>
<b>Mean</b>	<b>1</b>	<b>1</b>	<b>1</b>
<b>SD</b>	<b>0.154</b>	<b>0.157</b>	<b>0.067</b>

Source: Computed from EMS computer print-out.

constructed from the best performing DMUs with similar characteristics. However, when the CCR model is assumed, 36.7 percent had an efficiency score of less or equal to 0.79; whereas, when the BCC model is applied, 28.3 percent had their efficiency scores less or equal to 0.79. The results of returns to scale estimation indicated that all of the technically efficient farmers (based on the CCR model) were operating at CRS, showing the optimum scale of their practices. The mean values for TE, PTE and SE were found to be 0.836, 0.887 and 0.943, respectively. Therefore, for adjustment purpose, the average farmer(s) need to increase his/her technical efficiency by 16.4 percent *viz.* appropriate techniques application to be on the frontier surface; in the case of PTE, farmer(s) need to reduce input costs incurred by approximately 11.3 percent to be on frontier surface, and in the case of SE, farmer(s) need to increase their scale productivity by 5.7 percent *viz.* right input mix to be on the frontier surface. However, the wide variation in TE scores from 0.49-1.00, implies that all the farmers were not fully aware of the right production techniques or did not apply them properly. Also, the relatively low average scale efficiency score indicates the disadvantageous conditions of scale size, thus, implying that if all the inefficient farmers operated at the most productive scale size, approximately 5.7 percent cost savings of input use from different sources would be possible without affecting the yield level.

### Performance assessment of efficient farms using weight

Performance assessment can be carried out by comparing a particular system with key competitors having best performance within the same group or another group performing similar functions, a process called benchmarking (Jebaraj & Iniyar, 2006; Sadiq *et al.*, 2015; Sadiq *et al.*, 2016). Efficient DMUs can be

selected by inefficient DMUs as best practice DMUs, making them a composite DMU instead of using a single DMU as a benchmark. A composite DMU is formed by multiplying the intensity vector  $\lambda$  in the inputs and outputs of the respective efficient DMUs. BCC is modeled by setting the convexity constraint and the summation of all intensity vectors in a benchmark DMU must be equal to unity. A perusal of Table 3 shows the worst inefficient DMUs (DMU15 and DMU17) and the best inefficient DMUs (DMU03 and DMU54). For instance, in the case of DMU15 the composite DMU that represents the best practice or reference composite benchmark DMU is formed by the combination of DMU09, DMU37, DMU02 and DMU44. This means DMU15 is close to the efficient frontier segment formed by these efficient DMUs represented in the composite DMU. The selection of these efficient DMUs is made on the basis of their comparable level of cost of cultivation incurred and profit made to DMU15. Furthermore, the benchmark DMU for DMU15 is expressed as 9 (0.594) 37(0.214) 2(0.070) 44(0.122); where 9, 37, 2 and 44 are the DMU numbers while the values between the brackets are the intensity vector ( $\lambda$ ) for the respective DMUs. The higher value of the intensity vector ( $\lambda$ ) for DMU09 (0.594) indicates that its level of cost of cultivation incurred and profit made is closer to DMU09 when compared to other DMUs.

**Optimum cost of cultivation required in maize production**

The optimum cost of cultivation and cost saving from various input costs used in maize production using BCC model are presented in Table 4. It gives the average cost of cultivation in actual and optimum conditions, possible

cost savings and CSTR percentage for different input costs sources. The actual cost of cultivation stood at N24159.09, and can be reduced to N16232.37 while maintaining the current yield level and also assuming no other constraining factors. This implies that by following the recommendations resulted from this study, approximately N7926.27ha<sup>-1</sup> (32.81per cent) been part of the actual cost of cultivation incurred could be reduced while maintaining the present yield level of 667.19kg and also assuming no other constraining factors. Decomposition analysis showed the optimum required costs to be incurred on family labour (opportunity cost), paid labour, seeds, fertilizer, biocides and depreciation on capital items to be N4051.60, N3147.99, N1458.61, N4873.90, N1700.61 and N999.66, respectively. Furthermore, results of CSTR showed that if all farmers operated efficiently, reduction in costs incurred on depreciation on capital items, family labour (implicit cost), paid labour, biocides, fertilizer and seeds, with respect, by 45.94 percent, 35.38 percent, 34.19 percent, 32.18 percent, 30.47 percent and 16.12 percent, respectively, would be possible without affecting their current yield levels. It was observed that costs incurred on capital item depreciation, family labour, paid labour, biocides and fertilizer recorded the highest inefficiency, owing mainly to excess use in order to reap high yield and also because labour input is free and cheap in the study area, given that there is no alternative avenue to channel the excess into. Therefore, improving cost efficiency of these farms by a proper financial management of financial resources in individual farm-firm together with equity

**Table 3: Performance assessment of efficient farms using weight**

Farm	PTE score (per cent)	Benchmark
DMU15	52.9	9(0.594) 37(0.214) 2(0.070) 44(0.122)
DMU17	54.3	2(0.048) 14(0.139) 37(0.139) 9(0.637) 44(0.037)
DMU03	97.5	44(0.100) 9(0.99)
DMU54	97.9	52(0.048) 57(0.952)

Source: Computed from EMS computer print-out.  
 Figures in parentheses are intensity vectors

**Table 4: Average actual cost-projected cost and cost savings per hectare from different sources**

Inputs	Actual cost	Optimum cost	Cost saving (ha <sup>-1</sup> )	CSTR	Cost saving
Family labour	6269.73	4051.60	2218.13	35.38	27.99
Paid labour	4783.33	3147.99	1635.34	34.19	20.63
Seeds	1739.00	1458.61	280.39	16.12	3.53
Fertilizer	7010.11	4873.90	2136.21	30.47	26.95
Biocides	2507.69	1700.61	807.08	32.18	10.18
Depreciation	1849.22	999.66	849.56	45.94	10.72
<b>Total cost</b>	<b>24159.09</b>	<b>16232.37</b>	<b>7926.27</b>	<b>32.81</b>	<b>100</b>

Source: Computed from EMS computer print-out  
 R<sup>2</sup> = 0.78

protection is imperative; channeling the excess labour into alternative sources, thus increasing farming household income stream, and education on appropriate management techniques in resource allocation *viz.* adequate extension services are necessary. It is worth to note that all input costs incurred in the production were not rationally allocated by the farmers in the study area. Moreover, the CSTR percentage for cost of cultivation was 32.81 percent, indicating that by adopting recommendations proffered by this study, on the average; approximately 32.81 percent (N7926.27) from the actual cost of cultivation incurred in producing maize crop could be reduced without affecting the productivity level. Using this information, it is possible to advise the inefficient farmers regarding the better costs allocation and operating practices followed by his peers in order to reduce incurred input costs levels to the optimum costs indicated in the analysis while maintaining the yield level presently achieved by them.

The last column in Table 4 shows the distribution of the various sources in the total input cost saving. Evidently, the cost of family labour (27.99 per cent) accounted for the maximum contribution to total cost saving followed by the cost of fertilizer (26.95 per cent) and then the cost of paid labour (20.63 per cent). Also the cost saving shares from depreciation on capital items, biocides and seeds were relatively low, indicating that, they have been used in the right proportions by almost all the farmers. Based on these findings it is strongly suggested that improving the usage pattern of these inputs be considered as priorities that will enhance significant

improvement in cost allocation for maize production in the study area. Substituting inorganic fertilizer with organic manure *viz.* farm yard manure and animal dung are suggested to reduce and prevent cost wastage by inefficient farmers. Applying better crop management technique *viz.* sustainable crop practices and creating competing sectors to absorb the excess labour used in the farm are recommended, thus, minimizing incurred cost of cultivation.

#### Improvement of economical indices for maize producers

The improvements of economical indices for maize production in optimum requirement/projection are presented in Table 5. Results showed that by operating at projected costs for inputs used in the production, the net farm income, gross margin, benefit-cost ratio, return on naira invested (ROI), rate of return on capital invested (RORCI), net operating margin (NOM), profit margin on sales (PMS) and TFP indicators can improve by 14.18, 12.26, 48.94, 64.48, 67.53, 12.50, 14.29, and 48.94 per cent, respectively. Also, the cost of cultivation, cost of production, gross ratio (GOR), operating ratio (OR) and fixed ratio (FR) would reduce by 32.81, 32.81, 33.33, 32.14, and 50 per cent, respectively.

#### Constraints Affecting Maize Producers

Using the decision rule to categorize extent/severity of problem, any constraint having mean score greater than  $X=2.5$  is termed most severe problem while any with mean score less than the Likert scale mean value of  $X=2.5$  is termed less severe problem: high cost of agrochemical inputs, high cost of other inputs, capital paucity, poor

**Table 5: Improvement of economical indices for maize producers**

Items	Units	Actual (A)	Optimum (B)	Difference [(B-A)/A]*100
TVC	Nha <sup>-1</sup>	22310.00	15232.71	-31.72
TFC	Nha <sup>-1</sup>	1849.22	999.66	-45.94
Cost of cultivation	Nha <sup>-1</sup>	24159.09	16232.37	-32.81
Cost of production	Nkg <sup>-1</sup>	36.21	24.33	-32.81
Total revenue	Nha <sup>-1</sup>	80062.33	80062.33	-
Gross margin	Nha <sup>-1</sup>	57752.33	64829.62	12.26
Net income ( $\pi$ )	Nha <sup>-1</sup>	55903.25	63829.97	14.18
Benefit-Cost ratio	-	3.31	4.93	48.94
Gross ratio	-	0.30	0.20	-33.33
Operating ratio	-	0.28	0.19	-32.14
Fixed ratio	-	0.02	0.01	-50
ROI	-	2.59	4.26	64.48
RORCI	-	2.31	3.87	67.53
NOM	-	0.72	0.81	12.50
PMS	-	0.70	0.80	14.29
TFP	-	3.31	4.93	48.94
Yield	Kg ha <sup>-1</sup>	667.19	667.19	-

Source: Authors' computation

**Table 6: Constraints affecting maize producers in the study area**

Constraints	Mean	STD	Varimax rotated component matrix			
			1	2	3	4
High cost of agrochemical inputs	3.70 (1 <sup>st</sup> )	0.619	.759			
High cost of other inputs	3.57 (2 <sup>nd</sup> )	0.621	.738			
Paucity of capital	3.55 (3 <sup>rd</sup> )	0.565	.702			
High cost of labour	2.32 (9 <sup>th</sup> )	1.127	.695	.513		
Price fluctuation/instability	2.17 (10 <sup>th</sup> )	1.03		.847		
Poor storage facilities	2.43 (8 <sup>th</sup> )	1.155		.843		
Weather vagaries	3.27 (5 <sup>th</sup> )	0.548		.556	.812	
Pest and diseases	2.60 (7 <sup>th</sup> )	0.786			.783	
Inadequate credit facilities	3.35 (4 <sup>th</sup> )	0.936				.807
Poor extension service delivery	2.87 (6 <sup>th</sup> )	0.83				.711
Variance	66.87		24.72	20.03	11.57	10.55
Cronbach's alpha			.719	.693	.601	.550
Kaiser-Meyer-Olkin measure of sampling adequacy	.618					
Bartlett's test of sphericity (Approx. 2)	281.92					
Degree of freedom	55					
Significance	0.000					
Kendall's coefficient (W)	0.032**					
$\chi^2$ cal	17.28					
$\chi^2$ tab	16.92					

Source: Field survey, 2016

credit delivery, climate change phenomenon, poor extension service delivery and pest and diseases are the major constraints; while the remaining fall under minor constraints affecting maize production in the study area (Table 6). These constraints were ranked in ascending order from the most pressing constraints to the least ones for proper policy intervention: four top-rated constraints are high cost of agrochemical inputs, high cost of other inputs, capital paucity and poor credit delivery. Furthermore, Kendall's coefficient of concordance index of 0.032 which is significant at 5 percent as evidenced by the  $\chi^2$ -cal ( $\chi^2$ ) value of 17.28 which is greater than the  $\chi^2$ -tab ( $\chi^2$ ) value of 16.9190, implies that there is weak concordance/agreement among the farmers' with respect to this ranking. However, to stratify the identified constraints to an interpretable set of factors, principal factor analysis with Varimax rotation model was used, thus resulting in four-factors with an eigen value greater than one. The estimated indices of Kaiser-Meyer-Olkin (KMO) measure of sampling accuracy (0.618) and Bartlett's test of sphere city (281.92) indicated that the matrix was suitable for factor analysis. The four-factor solution provided the most interpretable factors, and they explained 66.87 percent of the total variance, which is a satisfactory amount in social sciences (Hair et al., 1998; Bagheri and Fami, 2016), while 33.13 percent variance was explained by other factors whose Eigen values were less than 1. A perusal of Table 6 showed the extracted

factors and their respective factor loadings, excluding those whose absolute value of the loadings was less than 0.40. The four extracted factors were labeled as input, market(output), climatic and institutional constraints, respectively. However, in labeling of factors that were loaded from three factor loadings, only the highest factor score was considered.

Factor 1 labeled input constraint accounted for 24.72 per cent of the variance, had high loading from high cost of agrochemical inputs, high cost of other inputs, paucity of capital input and high cost of labour. Factor 2 labeled market constraints (output) which accounted for 20.03 per cent of variance was highly loaded from price fluctuation/instability and poor storage facilities. Weather vagaries and pest and diseases labeled climatic constraints were loaded on Factor 3, and accounted for 11.57 per cent of variance. Factor 4 labeled institutional constraints which explained 10.55 per cent of variance had high loading from inadequate credit facilities and poor extension service delivery. However, Cronbach's alpha indexes for factor 1, factor 2, factor 3 and factor 4 were 0.719, 0.683, 0.501 and 0.550, respectively, implying that there is association; consistency and reliability between the constraints loaded on each factor.

#### CONCLUSIONS AND RECOMMENDATIONS

This research lucidly determines the economic efficiency of maize production in Niger State of Nigeria using Data Envelopment Analysis, given that this

technique helped in segregating efficient farmers from inefficient farmers; determine farms with best practices; identifying wasteful uses of production costs by inefficient farmers; rank efficient farmers; rank input utilization by using technical, pure technical and scale efficiencies; and provide helpful insights for farm management. Results showed that of the total 60 farmers subjected to analysis under CRS and VRS, 23.3 and 51.7 per cent were found to be technically and pure technically efficient, respectively. The estimated mean technical, pure technical and scale efficiencies of the farmers were 0.836, 0.887 and 0.943, respectively. The cost of cultivation incurred in maize production in the study area stood at N24159.09 and was mainly due to costs incurred on fertilizer and labour. On the average, the incurred actual cost of cultivation could be reduced by 32.81 per cent without reducing the yield from the present level if the farmers adopt the recommendations proffered by this research. It was observed that costs of family labour, fertilizer and paid labour in descending order had relatively higher shares in the distribution of total input cost savings for inefficient farmers. If inefficient farmers would pay more attention to these costs, they would improve their economic productivity. Also, by optimization of cost use, net farm income, gross margin, ROI, TFP would improve by 14.18, 12.26, 64.48, and 48.94 per cent, respectively; while cost of cultivation, cost of production, operating ratio and gross ratio would decrease by 32.81 per cent, 32.81 per cent, 32.14 per cent and 33.33 per cent, respectively. Therefore, from these foregoing, study recommends that efficient financial resource management and production management practices should be adopted by the farmers' in the study area in order to achieve optimum economic efficiency in maize farming:

- Study advocate for competitive input markets so that the farmers will not feel the brunt of subsidies removal, which in turn will make the farmers' have a favourable balance of trade that is, ratio of price received by the farmer (output) to price paid by the farmer (input).
- Farmers should be enjoined to join social societies so that they can take advantages and benefit from pecuniary advantages such as bulk discounts in inputs purchases, bargaining power in marketing of their products, innovative enlightenments and valid information viz. diffusion.
- Study advocates for more canalization of direct private investment in agricultural activities i.e farmers-processors linkage/contract farming/contract marketing.
- Study advice inefficient farmers' to pay more attention in the allocation of capital items, labour and agrochemicals in order to enhance their economic efficiency.
- Need arise for capacity training of arable crop farmers' to enable to cope with the challenges of innovative farming and commercialization of crop subsector in the studied area.
- Study enjoined farmers to inculcate the attitude of accurate supervision and record keeping for better farm management.
- There is need to increase farmers-change agents' ratio in the study area, and also as a precondition, change agents' should be motivated viz. feasible incentives in order to get viable results in agriculture.

Both government and private institution should make farming a business viz. creation of enabling and conducive business oriented environment, thus putting away unfair/sharp practices in input and output markets which hampered value chain efficiency.

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## **Promoting Win-Win Farmer-Industry Interaction: Case of Good Agricultural Practices**

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### **ABSTRACT**

*This paper is an attempt to understand the concept and need for good agricultural practices towards improving farm incomes especially for horticulture crops. Consumers are becoming very conscious towards quality of the product they are getting in the market. This marks backward linkages towards farming to take concerns of the safety and quality of the produce. Training and capacity building activities can result in the successful implementation of said practices. Thus, farmers can widen scope by targeting organized retail and export or domestic market to maximize net returns. Captioned study underlines the importance of Good Agricultural Practices (GAP) not only in trade but also for the betterment of the society and environment. An attempt has been made to describe application and need of GAP in horticulture sector.*

### **Keywords**

Backward linkages, capacity building, farm income, food agricultural practices, horticulture sector

### **JEL Codes**

Q13, Q17, Q01, M38, Y90

### **INTRODUCTION**

World agriculture in the twenty-first century is faced with three main challenges: 1) to improve food security, rural livelihoods and income; 2) to satisfy the increasing and diversified demands for safe food and other products; and, 3) to conserve and protect natural resources (Alex, 2001). Agriculture is expected to assure food security in a range of settings, now and in the future, and is increasingly called upon to produce positive environmental, social and economic benefits. While agriculture is a key contributor to sustainable development and to meeting these challenges, the paradigm is dramatically shifting for its primary producers in the context of a rapidly changing food economy and globalization (www.qcin.org). These challenges can be tackled in part through a Good Agricultural Practices (GAP) approach—a means to concretely contribute to environmental, economic and social sustainability of on-farm production resulting in safe and healthy food and non-food agricultural products. (www.nature.org) A GAP approach can address the demand-side priorities of consumers and retailers, the

supply-side priorities of producers and those institutions and services that are bridging supply and demand (www.fao.org).

The GAP concept addresses two distinct issues: ensuring the safety of food and other agricultural products during on-farm and post-production processes, and enhancing environmental sustainability for permanently productive farm operations. It also contributes to socioeconomic sustainability. The development and adoption of GAP has become increasingly important in light of increasing regional and international trade in food and other agricultural products, as well as the growing consciousness of consumers of the quality, safety, and hygiene of the products they buy.

### **Misconceptions and Need for GAP**

Many farmers and agricultural practitioners all over the world have difficulty understanding the GAP standards that have been set by national authorities, international agencies, or retailers. Their first impression of GAP standards or GAP schemes is simply of prohibitions on many of their farm activities. In addition, numerous farmers who use traditional farming methods

feel that GAP is an affront to their practices (Salami *et al.*, 2010).

The majority of farmers now use modern chemicals in every aspect of their daily practice, including crop production, crop protection, plant growth, post-harvest treatment, and storage life in order to improve their yield productivity and quality and to protect their crops from pests and diseases. However, poor practices in the use of these chemicals can result in the creation of toxic waste and crop products can become contaminated with toxic residue. This also disturbs the ecological balance of flora and fauna in the farm and the surrounding environment. The negative consequences of poor practices coe full circle to affect food production, the livelihoods of farmers, and consumers.

GAP aims to bring balance into the food production equation. It helps all stakeholders of the food production chain to understand the importance of food safety, the necessity of a sustainable food production system, and the fact that we must not produce waste. GAP does not prescribe techniques to increase crop productivity. It does, however, help farmers to effectively produce profitable and sustainable crops, creating benefits that directly affect them manual on GAP, 2016 ([www.apo.org](http://www.apo.org)).

Misconception of GAP has hindered the introduction and adoption of GAP practices. There is a belief that GAP standards are restrictive and obstruct farmers and their agriculture processes. However, the fundamental guiding principal of GAP is the achievement of a safe and sustainable food production system for growers and consumers. This safe production system is necessary to ensure the right of consumers to hygienic, nutritious, and affordable food. In addition, it is also essential for food production to safeguard the health, hygiene, and welfare of growers and farm workers. They must not be exposed to hazards and dangers during input applications. Farmers are most concerned about growing successful crops that allow them to sell quality products at a favorable price. However, the power of the market rests heavily in favor of consumers. Consumers now demand and expect that GAP standards are applied for market access for many food crops. Crops from farms that are not compliant with GAP standards have to be traded in lower market destinations, which also means they are sold at lower prices.

Under such conditions, farmers, particularly small and rural farmers in Asia, have a desperate need to understand the workings of GAP. They must learn how to capture the opportunities and avoid the pitfalls of being trapped in a food market system where their crop products are sidelined in the food supply chain (FSC).

#### **Consumer Demand as a Driver of GAP Promotion**

International trade has expanded tremendously over the last decades due to the changing consumer behaviors and tastes, developing in high-value food products, transportation and other supply chain technologies (The World Bank, 2005). Even though a wide range of

developing countries have successfully expanded their exports of agricultural and food products, there is growing concern that a serious lack of food safety and agricultural health standards could undermine this progress. The occurrence of food related health hazards due to infective agents which include virus, bacteria and parasites and toxic agents including pesticides have raised the doubts about the safety and reliability of food production systems. Thereby, a new paradigm shift in agricultural production is ushered in the 21<sup>st</sup> century, where there is more concern about safety and quality of the produce for an increasingly discriminating consumer worldwide.

The international trade of the agricultural commodities had started showing a steady increase during the post WTO era. The export and import of agricultural produces became imperative and simultaneously, the concern about the safety issues related to food products also gained momentum at the international level. Many countries in Europe and North America prepared such technical regulations to ensure safety of food products. This has led to the complications and new problems like shipments from developing countries being held up due to the presence of pesticide residues and harmful elements beyond the permissible limits in the consignment. Related to India there are various examples in the past years regarding the ban of the consignment (e.g. Mangoes, Chili and some other vegetables) due to exceeding Maximum Residual Levels (MRLs).

Traceability can alleviate the problems related to food safety in all stages of the production from farm to the consumers table. By this, consumers gain the confidence on the safety of the food products. But the primary difference between the safety and confidence should be recognized by the consumers. The chief responsibility of the producer is to supply safer produce to consumers and to gain their confidence. To achieve this, the producers should properly communicate that they grow their produces under safe practices. At this juncture, a strategy formulation is felt to be crucially important and it has led to the genesis of the GAP to ensure safer foods to the consumers worldwide and to improve international trade.

#### **Exposure of GAP in India**

Private certification agency GLOBALGAP (GGAP) exists in India to provide GAP certification to the produce since 2003; quite recently INDGAP got established to facilitate the process. With the aim of providing safe and quality produce national GAP program was implemented in September 2014. It has provision for both domestic as well as international market under its specified modules for both types of market.

As per the data available upto 2008, number of GGAP certified producers is presented under Table 1 shown below. Results are indicating that there is fluctuation in the number of certified growers under both categories i.e. individual grower and farmer group. Under the individual

**Table 1: GLOBALGAP certification in India**

Year	Number of growers under option -1 (Individual grower)	Number of growers under option -2 (Farmer group)
2003	12	Nil
2004	48	4 (46)
2005	139	11 (440)
2006	243	6 (357)
2007	224	10 (475)
2008	195	16 (1214)

Source: QCI archives, 2011

Figures in parentheses are number of growers in particular group

grower category, highest number observed in year 2006. However in year 2008 there is a slight decrease in number.

**Case study for successful GAP implementation in India**

FICCI-NOARD national project 2007-10 resulted in introduction of better standards in agricultural practices in line with international standards and financial benefits to farmers through increased exports of fruits and vegetables.

The project achieved notable success in creating awareness of these standards in several states of the country. Maharashtra came into greater focus due to the production of grapes and mangoes, the two major fruits with high export potential. The project resulted in certification of 210 farms which included *alphonso* and *kesar* mango growers (www.msamb.com). It has been recorded by Agricultural and Processed Food Products Export Development Authority (APEDA) that EUREPGAP certified grapes boosted India's exports to Europe and *alphonso* and *kesar* mangoes were exported for the first time in the history of the country. As per data available on Maharashtra State Agriculture Marketing Board, total number of GLOBALGAP certified growers in Maharashtra are about 118 as per information retrieved up to June 2016.

**Advantages and benefits of GLOBALGAP implementation**

Research carried out by Yadav (2008) for comparing economics of GAP certified and non certified mango growers in Konkan region of Maharashtra has shown that benefit cost ratio of GAP adopter group was 2.78 while 1.66 in case of non adopters. Further there is successful example of Mahagrapes co-operative for providing lucrative prices to farmers by ensuring GAP. GLOBALGAP is an internationally recognized set of farm standards dedicated to Good Agricultural Practices. Through certification producers demonstrate their adherence to GLOBALGAP standards (Sharma & Mathur, 2016). This standards are specific to European standards while applicable thorough out the world. Various advantages and benefits associated with implementation of these standards are as:

- Increased consciousness of safety of the raw agricultural produce has been inculcated
- Controlled use of pesticides and fertilizers in the field has been established to conform the absence of any residues or there being well within tolerance limits
- Introduction of better standards in agriculture practices in line with international standards such as product attributes, insect, pest free, maintaining minimum residue level
- Increased confidence among European importers about quality and safety of fruits from India and availability of safe produce for domestic customers
- Financial benefits to farmers through increased exports of fruits and vegetables and better price realization from exporters and domestic retail chains

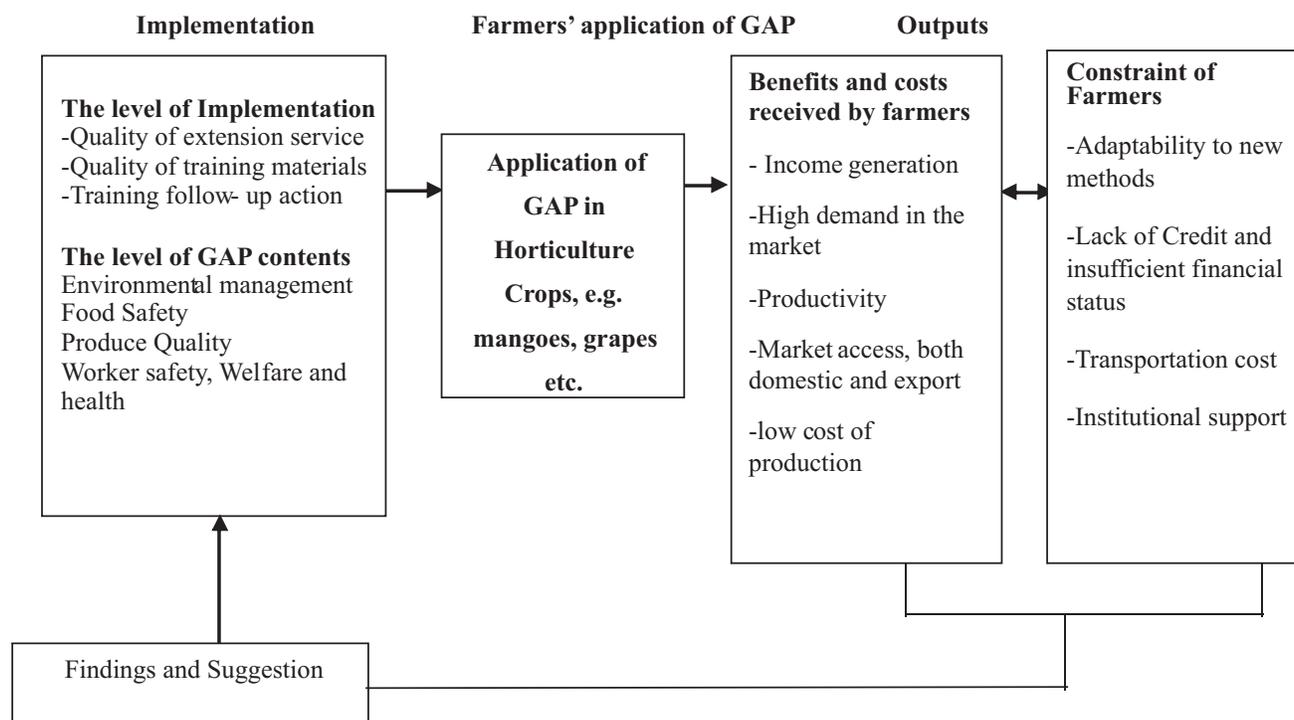
**Constraints of Small and Rural Farmers in implementing GAP**

Many small and rural farmers in the developing countries of Asia lack the management skills and production practices that would aid them in adopting and developing GAP processes. These farmers also have poor financial resources and cannot afford the costs of compliance with GAP requirements. Individual development authorities in these countries have already undertaken many programs to address these deficiencies. However, these constraints continue to haunt small and rural farmers.

The current view is that because small and rural farmers from these developing countries often have not participated directly in the market system, this explains their lack of interest in implementing GAP in their practices. It is also believed that the existence of numerous multi-tiered marketing intermediaries have decreased the motivation of small and rural farmers to adopt GAP systems of production. However, as supermarket expansion in Asia continues with more direct sourcing from farms, there are greater opportunities for small and rural farmers to directly participate in the mainstream market system. Supermarkets have also argued that the reduction of marketing intermediaries will reduce distribution costs and that the savings could be returned to farmers. This direct sourcing approach benefits the farmers with higher returns on farm gate prices, and linking them to the market will encourage them to adopt GAP programs.

Shown above is the proposed framework for successful inception of GAP. Here, it is divided into phases as Implementation, Adoption of application of GAP and output validated on both sides of the coin i.e. Income point of view and constraints which can be further taken for improvements. Further it is proposed that this model can be PPP.

## Proposed Conceptual Framework for GAP in Indian context



Source: Author's own computation from literature study

### CONCLUSIONS

Although GAP implementation has major challenges like, record keeping, affordability, mind sets etc. but still there is a bright future for these standards to spread all over the country.

Initially, government need to work hard for conducting various capacity building programs to sensitized the growers about GAP and its applications. Additionally, to ensure traceability there should be record keeping and regular checks from State horticulture/agricultural department should be made compulsory to ensure the process. But this is not enough; government should provide linkages to suitable markets to growers so that they can fetch higher prices. Although GAP certified product having its own demand in the market but without proper channelization price realization to growers cannot be met so provision of suitable market access should be there. By focusing on these things successful implementation of GAP can be made viable and it creates the win-win situation for farmer and for the market side (consumer point of view).

### ACKNOWLEDGEMENT

This thematic paper is the part of working doctorate thesis of corresponding author titled, 'Indian Mango Exports and Good Agricultural Practices: Prospects and

Challenges', which includes study of Good Agricultural Practices, in 4 states namely, Andhra Pradesh, Maharashtra, Gujarat and Uttar Pradesh. Based on the findings conceptual framework for GAP, its pros and cons to farmers are highlighted in the paper.

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## **Application of Conjoint Analysis for Consumer Preference Evaluation of Ragi in Karnataka**

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### **ABSTRACT**

*Conjoint Analysis is a statistical technique where respondents ranked preferences for different offers are decomposed to determine the person's inferred utility function for each attribute and the relative importance of each attribute. The present study was attempted to evaluate the consumer preference for ragi in Karnataka using conjoint analysis. The required data was collected from 120 sample respondents from Bengaluru and Vijayapura districts, respectively using structured interview schedule for the selection of attributes, later based on the consumer preferences the cards were generated in SPSS and same was used to evaluate the consumer preference for new release of ragi variety. The results reveal that, among all the attributes of ragi studied in Bengaluru urban, taste was found to be most important and first consideration of consumers accounting for 39.33 per cent of relative importance with good taste having the utility of 1.21. In case of Bengaluru rural, price was found to be most important and first deliberation, accounting for 35.60 per cent of relative importance. Among all the attributes studied in ragi in Vijayapura urban, colour was found to be most significant and first consideration, accounting for 41.39 per cent. In case of Vijayapura rural also colour was found to be most significant and first consideration, accounting for 36.23 per cent. Therefore colour was one of the most important attribute, so research has to be taken up to develop coloured ragi varieties with bioavailability of nutrients.*

### **Keywords**

Attributes, conjoint analysis, consumer preference, relative importance, utility

### **JEL Codes**

D12, C38, C35, C52, C87, M39

### **INTRODUCTION**

Ragi in India is one of the important cereals which occupies the highest area under cultivation among the small millets. The state of Karnataka is the largest producer of ragi in India. It is gaining importance in recent years due to its medicinal and nutritive value. The value addition brings more returns to the farmers and enhances nutritional status of their family members. It is in this context, the present study has been taken up to analyze willingness to pay for the farmers as well as consumers will be estimated.

In 2012-13, India produced 19.29 lakh tonnes of ragi from 13.07 lakh hectares with an average productivity of 1641 kg per hectare. Karnataka tops the Indian ragi production with a contribution of 67 per cent followed by Tamil Nadu (11 per cent), Uttarakhand (9 per cent) and Maharashtra (7 per cent) (Anonymous, 2013).

Ragi is gaining importance in the recent years due

to its medicinal and nutritive value. The value addition brings more returns to the farmers and enhances nutritional status of their family members. It is in this context, the present study has been taken up to analyze the growth and instability, market competitiveness in production and value addition of Ragi. In this study willingness to accept and pay for the biotechnologically improved varieties by farmers as well as consumers will be estimated.

### **Conjoint Analysis**

Conjoint analysis is a versatile marketing research technique that can provide valuable information for new product development and forecasting, market segmentation and pricing decisions, advertising and distribution, competitive analysis and repositioning. It is a technique used in assessing consumers/farmers value judgments. Hence, in the present study, it was used to measure the consumer's preference for ragi.

The features included in a conjoint analysis experiment correspond to important consumption characteristics or characteristics hypothesized to influence purchase behavior. The levels are sample values for each of the selected features and should span the realistic range of each feature.

The conjoint experiment employs a full-profile approach, in which the level of each feature of the consumption to be rated is specified. In a full-factorial design, in which every possible combination of feature levels is rated, the number of attributes to be rated.

What attributes were important or unimportant to the consumers? What level of ragi attributes are the most or least desirable in the consumer's mind? Answer to these questions of crucial importance in the purchase and consumption of ragi were analysed using conjoint analysis technique.

**METHODOLOGY**

**Study Area**

The study was conducted in Bengaluru and Vijayapura districts of Karnataka. Two districts namely ragi growing district (Bengaluru) and non ragi growing district (Vijayapura) were purposively selected

**Sampling Framework**

The samples were selected using multistage random sampling technique. For selection of sample consumers, two regions namely ragi growing region (Bengaluru district) and non ragi growing region (Vijayapura district) were purposively selected. In each region, consumers were divided into rural consumers and urban consumers. From the ragi growing region of Bengaluru, 30 consumers were chosen randomly from urban locations while 30 from rural locations, similarly for non ragi growing region of Vijayapura, 30 urban and 30 rural consumers were chosen randomly. Thus the total sample size was 120 consumers.

The study is based on the primary data. The primary data required for the analysis was collected from the sample farmers using structured schedule through personal interview. The data was pertain to the year 2014-15.

**Analytical Tools Used**

**Conjoint analysis**

Conjoint analysis is a multivariate technique that is commonly used to determine the relative importance of a product's multidimensional features, and it is particularly well suited for measuring human perceptions and preferences (Green & Wind, 1975; Louviere, 1988). The analysis refers to any decompositional method that estimates the structure of buyers' preferences for a product's features, given the buyers' overall evaluations of a set of products described by levels of specific features (Green & Srinivasan, 1978).

Using conjoint analysis, a researcher can analyze a heterogeneous product market and obtain results that can be highly disaggregated into homogeneous groups of buyers. Alternatively, aggregating results for buyers who

have similar preference or utility functions can be useful in modifying current products or services and in designing new ones for selected market segments (Green and Wind, 1975).

The additive conjoint model was used in this study. The model has been formulated as:

$$Y = \sum_{i=1}^n \sum_{j=1}^m V_{ij} X_{ij}$$

Where,

Y = Consumers' overall evaluation of the ragi.

V<sub>ij</sub> = Part worth associated with 'j' (1,2,3, .....m) of attributes, 'i' (1,2, .....n) the attributes are given in Table 1 for consumers.

X<sub>ij</sub> = Dummy variable representing the preference of the j<sup>th</sup> level of i<sup>th</sup> attribute.

For this study, profile describing alternatives was constructed by combining levels of four attributes. The attributes and their levels were identified through discussions with the consumers during the survey and also on consultation with marketing specialists, thus 10 cards were generated with different combinations and same was used for the collection of consumers preferences in the study area.

**Table 1: Attributes and attribute levels of ragi considered for conjoint analysis**

Attributes	Attribute levels
Taste	a. Good b. Average
Colour	a. Red b. White
Price	a. High (> ₹25/Kg) b. Medium (₹20-25/Kg) c. Low (< ₹20/Kg)
Cooking time	a. More b. Less

**RESULTS AND DISCUSSION**

**Pattern of Attributes of Ragi Determining Consumer Preferences**

**Consumer preference of ragi in Bengaluru urban and rural locations**

The important attributes of ragi determining consumer preferences studied in Bengaluru urban and rural locations were taste, colour, price and cooking time. For each respondent, the part-worths were estimated using OLS regression analysis.

The fit of the additive model to the individual data was good. In case of urban area, Pearson's rank correlation value with 0.701 was significant at 5 per cent level, similarly, the Kendall's correlation value with 0.635 was also found to be significant at 5 per cent level. Similar pattern of correlations (Pearson's and Kendall's) were observed for Bengaluru rural locations (Table 2). This gives strong confidence in the suitability of the additive model.

**Table 2: Correlations between consumer preference of ragi in Bengaluru**

Correlations	Bengaluru urban	Bengaluru rural
Pearson's rank correlation	0.701**	0.729**
Kendall's tau correlation	0.635**	0.529**
Constant	0.682	0.724

\*\*Significant at 5 per cent level

The relative importance of the part worth functions was compared across different attributes within segments in order to arrive at the relative importance of each attribute. Average part-worths and the relative importance of the attributes for Bengaluru urban and rural were presented in Table 3.

Among all the attributes of ragi studied in Bengaluru urban, taste was found to be most important and first consideration of consumers, accounting for 39.33 per cent of relative importance with good taste having the utility of 1.21. Colour had a strong influence on consumer's preference after taste in urban area accounting for 23.56 per cent. The individual utilities were red and white colour ragi were 0.32 and -0.32, respectively. Price formed the third most important factor having a relative importance of 20.66 per cent. Cooking time had the least relative importance accounting 16.45 per cent, Consumers gave least importance to cooking time may be because in Bangalore urban region majority of households were using gas as cooking medium. Similarly, same pattern of preference was observed in Bengaluru rural. In general, consumption of ragi in urban areas was relatively lower, compared to rural areas may be due to substitution of other food additives. Meanwhile, as increase in income of individuals, the expenditure on necessities goes on decreasing and increasing trend on luxuries.

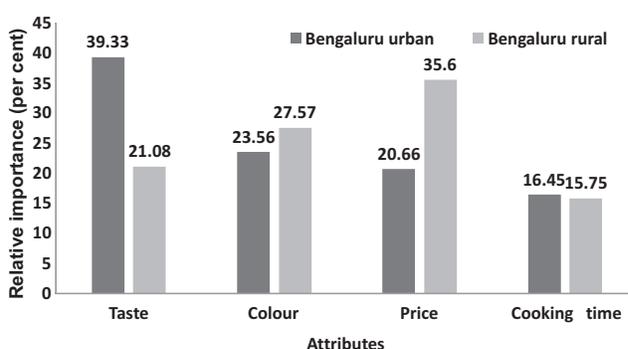
In case of Bengaluru rural, price was found to be most important and first deliberation, accounting for 35.60 per

**Table 4: Correlations between consumer preferences of ragi in Vijayapura**

Correlations	Vijayapura urban	Vijayapura rural
Pearson's rank correlation	0.676**	0.614**
Kendall's tau correlation	0.529**	0.513*
Constant	0.619	0.608

\*\* Significant at 5 per cent level

cent of relative importance, with more, medium and less price having the utility of -1.98, 1.89 and 0.12, respectively may be because majority of consumers belonged to middle-income group in rural region. Colour had a more influence on consumer's preference after price in urban area with a relative importance of 27.57 per cent. The individual utilities of brown and white colour ragi were 1.27 and -1.27, respectively. Taste had third most important factor influence on consumer's preference after colour, accounting for 21.08 per cent of relative importance, with good taste having the utility of 0.35. While, cooking time was least important attribute with relative importance at 15.75 per cent (Figure 1).



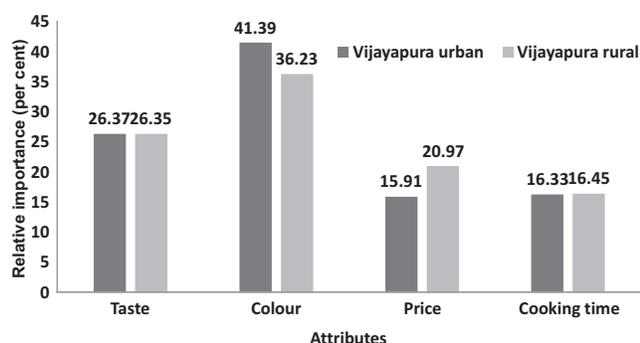
**Figure 1: Relative importance of ragi preference by urban and rural consumers of Vijayapura district**

**Table 3: Results of conjoint analysis of ragi preference by urban and rural consumers of Bengaluru locations**

Attributes	Attribute levels	Bengaluru urban (n <sub>1</sub> =30)		Bengaluru rural (n <sub>2</sub> =30)	
		Utility	Relative importance (per cent)	Utility	Relative importance (per cent)
Taste	Good	1.210	39.33	0.346	21.08
	Average	-1.210		-0.346	
Colour	Red	0.320	23.56	1.274	27.57
	White	-0.320		-1.274	
Price	High (> ₹25/kg)	-0.596	20.66	-1.985	35.60
	Medium (₹20-₹25/kg)	0.267		1.895	
	Low (<₹20/kg)	0.392		0.121	
Cooking time	More	-0.128	16.45	-0.284	15.75
	Less	0.128		0.284	
<b>Total</b>			<b>100.00</b>		<b>100.00</b>

**Table 5: Results of conjoint analysis of ragi preference by urban and rural consumers of Vijayapura locations**

Attributes	Attribute levels	Vijayapura urban (n <sub>1</sub> =30)		Vijayapura rural (n <sub>2</sub> =30)	
		Utility	Relative importance (per cent)	Utility	Relative importance (per cent)
Taste	Good	1.120	26.37	1.080	26.35
	Average	-1.120		-1.080	
Colour	Red	1.860	41.39	1.550	36.23
	White	-1.860		-1.550	
Price	High (> ₹25/kg)	-0.570	15.91	-1.750	20.97
	Medium (₹20-25/kg)	0.356		0.310	
	Low (< ₹20/kg)	0.190		1.440	
Cooking time	More	-0.220	16.33	-0.190	16.47
	Less	0.220		0.190	
<b>Total</b>			<b>100.00</b>		<b>100.00</b>



**Figure 2: Relative importance of ragi preference by urban and rural consumers of Vijayapura district**

**Consumer Preference of Ragi in Vijayapura Urban and Rural Locations**

To find out the fit of the additive model, Persons rank and Kendall's tau correlations were computed for both urban and rural locations of Vijayapura (Table 4). Pearson's rank correlation (0.676) was found to be significant at 5 per cent level. Similarly, Kendall's correlation value with 0.529 was also significant at 5 per cent level, indicating strong confidence in the suitability of the additive model for Vijayapura urban region. Similarly, for Vijayapura rural, the additive model was found to be fit since both Pearson's rank correlation value (0.614) and Kendall's correlation value (0.513) were significant at 5 per cent level.

The relative importance of the part worth functions was compared across different attributes within segments in order to arrive at the relative importance of each attribute. Average part-worths and the relative importance of the attributes for Vijayapura urban and rural are presented in Table 5.

Among all the attributes studied in ragi in Vijayapura urban, colour was found to be most significant and first consideration, accounting for 41.39 per cent. The

individual utilities of red and white colour ragi were 1.86 and -1.86, respectively, as the consumers prefer more of red color ragi due to the taste and nutritional quality. Taste had a strong influence on consumer's preference after colour, accounting for 26.37 per cent of relative importance, with good taste of ragi having the utility of 1.12. Next to taste, cooking time had a relative importance of 16.33 per cent. While, price was least important attribute with relative importance at 15.91 per cent.

In case of Vijayapura rural also colour was found to be the first contemplation and most important factor accounting for 36.23 per cent of relative importance, with red colour having the utility of 1.55. Taste was next important attribute after colour on consumer's preference, accounting for 26.35 per cent of relative importance, with good taste having the utility of 1.08. The third most important factor influence on consumer's preference was price accounting for 20.97 per cent of relative importance, with more, medium and less price having the utility of -1.75, 0.31 and 1.44, respectively. It may be due to majority of consumers belonged to low-income group in rural regions. Next to taste, cooking time had a relative importance of 16.47 per cent.

**SUMMARY AND POLICY IMPLICATIONS**

1. In ragi growing region of Bengaluru rural, the consumers considered price as most important attribute followed by colour and taste and preferring different varieties of ragi, whereas cooking time was considered least important attribute for preference of ragi.
2. In non ragi growing region of vijayapura district, urban respondents preferred colour as most important factor whereas price and cooking time were considered least important attributes while preferring ragi. On the other, rural respondents were preferred ragi based on colour.
3. Consumption of ragi was found to be considerably higher in rural regions as compared to urban regions.

4. Consumers are becoming more aware of the quality attributes of different commodities they are consuming, and consequently are choosing products that closely match their tastes and preferences. Demand for food products has increased among the consumers for a variety of reasons: unique quality, locality, supporting local producers.

Researchers and managers in agricultural and food industries often face problems relating to new product development, forecasting, market segmentation and pricing decisions, advertising and distribution, competitive analysis and repositioning. So a conjoint measurement study can assist them in solving these problems.

#### **POLICYIMPLICATIONS**

1. As there is a larger scope for ragi production in Karnataka as a rainfed crop, the ragi may be distributed under public distribution system (PDS) in all parts of the Karnataka.
2. The Government should encourage the farmers to grow more of ragi with improved practices to

enhance the yield of ragi.

3. Analysis of consumer preference indicated that colour was one of the most important attributes, so research has to be taken up to develop coloured ragi varieties with higher nutrient content.

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## **Stress, Coping Mechanisms and its Socio-Economic Impact on Organisations-A Review**

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### **ABSTRACT**

*This review paper examines the effects of work stress on organisational economy because satisfaction level of organisation have not been fulfilled and higher pressure for work has been created on employees to attain the desired goals. Home issues also affect the employee's performance in the job that directly affects the economy of an organisation. Therefore, stress is another name of job risk or threat. Work stress on employees created harmful effect on their health and cause some disorders such as physical and mental malfunctioning. This review paper will highlight the various forms of stress, its causes, effect on organisational economy and its coping mechanism.*

### **Keyword**

Coping mechanism, employees and malfunctioning, organisational economy, stress

### **JEL Codes**

Y80, Z13, Z18

### **INTRODUCTION**

Organisation is a group of people interacting together to achieve a common goal. It is a formal structure of authority through which work sub-divisions are arranged, defined and co-ordinated for the defined objective. So, Organisations are simply groups of people working towards the same goals or having the same purpose. Work stress affects the organisational economy because satisfaction level of organisation have not been fulfilled and higher pressure for work has been created on employees to attain the desired goals. Home issues also affect the employee's performance in the job that directly affects the economy of an organisation. Some important questions are strikes in mind when we think about effect of work stress on organisational economy, these questions will be: Does stress effect the health of employee □ Does stress affect the employee organisation relationship □ Does stress has any beneficial effects on organisation □ For these questions, this review paper will help to find the answers of these questions.

Economists have been interested to know the effect of employee's stress on economy of organisation. Kahn & Byosiere (1992) reported that family issues affect the employee's mind that affect his job performance and also

his work outcomes. Work stress along with home stress due to home disputes create post traumatic stress syndrome on employee mind. Such syndrome results in considerable economic burden on employee and his relation with an organisation.

According to Allen (1958), "Organisation is the process of identifying and grouping the work to be performed, defining and delegating responsibility and authority and establishing relationship for the purpose of enabling people to work most effectively together in accomplishing objectives." Broad categories of organisations are as follows:

#### **Public sector organisations**

Public sector organisations are owned by government. These are of various types like service sector for example education services, health services etc. Then enforcement sector like police, armed forces etc. and services enforcement sector which provide services as well as check the adulteration like Department of Agriculture. It provides the services to the farmers and also checks the quality of inputs. They should aim to get value for money. Value for money means getting the right quality at the lowest price, if public sector organisations cut costs but provide poor services, that aren't value for money. Nor are

very expensive services if the quality is higher than people really need. People want good services but they don't want to pay high charges. Best value means buying goods and services at competitive prices, but not lowering quality standards to do so (Manning and Preston, 2006).

#### **Private sector organisations**

Private sector organisations are owned by private individuals. Partnerships are very common in areas like professional services, where doctors, lawyers, architects and accountants join together to supply a service to the public. Other examples may be like manufacturing and sale of agricultural inputs like Jain brothers, vermi-composting units by farmers and organic agricultural production by farmers. Most people are employed by companies. Companies are owned by share holders-they own a SHARE in the business. The people who own private limited companies usually still run the business themselves.

#### **Non-profit organisations**

There are some organisations which don't try to make a profit. These are not the same as business which try to make profits and fail. They are non profit-making organisations. Some exist to provide services which are paid for by their customers, who share in any surplus that is made. These are called co-operative or mutual organisations. Other non-profit organisations are charities which have been set up to achieve specific goals. This can include supplying services, such as running children's homes, researching into cures for diseases, helping to relieve suffering and hunger, or bringing together people for social reasons. All non-profit organisations need to have clear goals and they have to be concerned about value for money. They must do their best to supply a service or achieve a set of goals as well as they can, without wasting resources in the process. Other important examples may be farmer's organisations like PAU Kisan Club, various NGOs and recently settled Senior citizen welfare association Ludhiana.

#### **Concept of stress**

Stress derived from the Latin word 'Stringer' which means to draw tight. Stress is defined as any altered physiological conditions caused by some factors that alter equilibrium in environment and human conditions. According to Selye (1956) stress is the nonspecific response of the body to any demand. Strain is defined as any physical change caused by stress. So, stress refers to a condition and stressor to the stimulus causing it.

Stress has become an un-separable part of people's life in modern world. The modern world which is said to be a world of achievements is also a world of stress. Stress is everywhere, whether it is in the family, business organization, enterprise, institute or any other social or economic activity. Right from birth till death, an individual is invariably exposed to various stressful situations. Stress has become a major concern of the modern times as it can cause harm to employee health and performance (Schuler, 1980). Organisational stress has

been increasing at an alarming rate due to many factors such as excessive work load, poor working conditions and poor managements which ultimately lead to poor performance of the organizations. Stress is caused by stressor which is an agent, condition, or other stimulus that causes stress to an organism and broadly it is the gap between the individual expectation and demand of organisation (Gupta, 2010). Consistently psychological disorders are increasing; the feelings of frustration and dissatisfaction with life in general reflect the stress being experienced by people.

Selye (1956) proposed three stage pattern of response to stress and called it general adaptation syndrome (GAS). **Alarm reaction:** The first stage includes an initial 'shock phase' in which resistance is lowered, and a 'counter shock phase' in which defensive mechanisms become active. When the threat or stressor is identified or realized, the body's stress response is a state of alarm. During this stage, adrenaline will be produced in order to bring about the fight-or-flight response.

**Resistance:** Maximum adaptation occurred during this phase if the stressor persists, it becomes necessary to attempt some means of coping with the stress. Although the body begins to try to adapt to the strains or demands of the environment, the body cannot keep this up indefinitely, so its resources are gradually depleted.

**Exhaustion:** Adaptation energy is exhausted, signs of alarm reaction reappear, and resistance level begins to decline irreversibly. At this point, all of the body resources are eventually depleted and the body is unable to maintain normal function. The initial autonomic nervous system symptoms may reappear (sweating, raised heart rate etc.). If stage three is extended, long term damage may result as the body, and the immune system is exhausted and function is impaired resulting in decomposition. The result can manifest itself in obvious illnesses such as ulcers, depression, diabetes, trouble with the digestive system or even cardiovascular problems along with other mental illnesses.

#### **TYPES OF STRESS**

A stressor is any event or situation that is perceived by an individual as a threat causing the individual to either adapt or initiate the stress response. Therefore, a stressor is a stimulus and stress is a response. Stressor is the cause and stress is the effect. Selye (1979) suggested that stress had four basic variations:

#### **Good Stress-Eustress**

It is the positive, desirable stress that keeps life interesting and helps to motivate and inspire people. Eustress involves successfully managing stress even if the individual is dealing with a negative stressor. It implies that a certain amount of stress is useful, beneficial and even good for health. There is increased energy, high motivation, shared perceptions and the performance improves quantitatively as well as qualitatively. Moderate doses of eustress help to improve an individual's performance.

### Bad Stress-Distress

It is one of the negative types of stress that the mind and body undergoes when the normal routine is constantly adjusted and altered. Again, these types of stress can be subcategorized into two types' acute stress and chronic stress. Acute stress is the body's way of getting a person to stand up and take inventory of what is going on, to make sure that everything is okay. This type of stress comes immediately with a change of routine. It is intense types of stress but it passes quickly. The second chronic types stress will occur if there is a constant change of routine for week after week. Chronic stress affects the body for long period.

### Over Stress-Hyperstress

It is another negative type, which comes when a person is forced to undertake or undergone more than one undergoes or one can take.

### Under Stress-Hypostress

It stands in direct opposite to the hyperstress. It is basically insufficient amount of stress, which is because hypostress is the type of stress experienced by a person who is constantly bored. It effects the feeling of restlessness and a lack of inspiration.

### ORGANIZATIONAL STRESS

Organizational stress is the stress, which occurs at the workplace. It is to be the result of those factors in an organization that cause stress for the individual employee, and in turn, have negative organizational consequences. For example, because of organizational needs or changes, factors such as increased workloads or changes in reporting relationships may occur. Such changes to the organization may precipitate a stressful environment it among the employees. The employee's stress may cause negative consequences, including absenteeism, lack of trust, performance problems, or an erosion of positive communication and interaction which ultimately reduces the organizational productivity and increases the disability among the working persons. Organizational stress is defined as an interaction between the employee and the work environment to which he is exposed (Shirom 1982). Sources of organizational stress setting includes work load, work design, job qualification, organization structure, responsibility and authority ambiguities (Rogers *et al* 1994) role ambiguity, role conflict, role overload (Jamal 1985) and lack of knowledge and lack of responsibility (Lee & Sabharwal 2014).

Factors which cause stress in organisations are as follows:

1. Salaries
2. Long/odd working hours
3. Over security of job/ Lack of security
4. Performance of duties
5. Sexual harassment
6. Unclear job responsibility
7. Career development/Promotion
8. Conflict between work and other role
9. Role overload
10. Lack of autonomy/ ability to make their own

decision about specific task

11. Isolation at work place
12. Physical work environment (noise, air quality, crowd)
13. Technological gap
14. Unavailability of resources
15. Interpersonal relations at work
16. Political pressure
17. Corruption

**Salaries:** This factor is a cause of stress in mostly small scale private organisations which demands more and more work in less money from the individual. The next issue is salary not provided on time which make stress in employee's life.

**Long/odd working hours:** It is the challenge of balancing the time demanded by work, with family and other non work activities. It includes the number of hours at work (paid employment), amount of travel time, inflexible work schedule and rotating shift schedule if any. Time based conflict is more acute for women than men as women have to spend more number of hours at home on household and child care activities than men. For example with the rise of technology, computer makes the eases with the accounting work. Any employee could check the work at his home even at night on the computer. His boss is only required the updates and completed files according to the previous day demand. One side we can see there is a relaxation in the attendance at office to cut his/her hours short, to be home during the day if he/she choose or take time off with family. However, the job also gives her the opportunity to work and to stay stressed around the clock even at home. In this case the individual trying to survive as both a employee and a parent (mother), but doing so requires his/her to draw mental boundaries between work and home. Michie & Williams (2003) reported that there are some important factors which are responsible for ill health of the employee in an organization and these are due to long working hours, work burden, less control over job tasks, no participation in making decisions and lack of social support.

**Performance of duties:** It is directly related with the over security of job/ lack of security of job. In public sector there is no risk of job security and in private organisation there is a less secure job. It adversely affects the organisational objectives. It depends with the employee's personal principle to perform his duty. It is seen that some employees not perform their duty rightly according to the need of organisation. They just passed the working hours by relaxing on their seats. In the public sector this type of problem generally seen. If one employee not perform his duty rightly it could create stress in organisation, it could affect the other working seats in organisations. Delay in task, poor quality of work appeared by this. On the other hand in private sector employee is always in stress to complete his task to secure his job e.g. insurance company.

**Sexual harassment:** it is unwanted contact or

communication of a sexual nature. For example many times we see in various organisations female employees reported that they had been the object of unwanted sexual advances, propositions or discussions at work place. The conditions are more stressful when the manager boss is not having the good character. This type of stressor is common in both public and private organisations.

**Unclear job responsibility:** A listing of the major duties and responsibilities of the position organised from essential to non-essential or most important to least important or maximum time spent to minimum time spent should be clear to the individual when he is joining the job. Stress is appeared when employee suddenly know about the new task after few days of joining. For example the private education institutes recruits the PAU's pass-out students for teaching purposes but it is personally seen that they pressurized them for non-teaching work even buying the lab instruments from the market after few days of joining of job. It makes stress and uncomfortable environment for the employees.

**Career development/Promotion:** This factor enhances employee's motivation and performance but causes dissatisfaction and stress if it is inadequate or absent. If the workers feel they are not being timely rewarded for their performance, they are likely to encounter stress. Major stressors related to career development are promotion, transfer etc. For example an employee can feel stress by under promotion (failure to advance as rapidly as desired) or over promotion (promotion to a job that exceeds the individual's competencies) (Khodabandeh & Sattari, 2015).

**Conflict between organisational and other role:** It occurs when people are expected to enact different work and non work roles. For example role for organisation and for family especially extended family. This type of stress is mainly seen in various organisations where no limit of working hours or responsibility. Uritkhinbam (2013) also reported that factors affecting the organisational stress such as self, family, environmental factors, role in organisation, interpersonal relationship at work, workload influence on career development lead to the stress as perceived by 36-50 per cent of the scientists.

**Role overload:** A feeling that too much is expected from the role than what the occupant can cope with. This type of stress is mainly considered for public organisations where the extra tasks are given to the individual who are not related to this job. For example census survey by the teachers or nursing staff.

**Lack of autonomy/ ability to make their own decision about specific task:** It is degree or level of freedom which allow an employee to make choices or take some necessary on-time decisions concerned to his job. Autonomy is important to improve the creativity of employees. This type of stress is mainly seen in public organisations where employees are unable to take any decision without superior. Private organisations are good in this field. They allow their employees to make the

decision themselves and get the best results. For example a small business like aachar and murabba manufacturing unit, an employee insists his boss at every step of choice of ingredient composition, but on the other hand the other employee does not get involved boss until it is time to taste the aachar or morraba. So it is clear that the second employee's management style is autonomous. By this, employee feels more valued and trusted and their output will improve, enhance their creativity and it may also happen that this new experiment of ingredients makes your product much hottest in your area. Private organisations are good in this. For example in the yester years the Jonson & Jonson Company passed through a big loss. Reason was that the chief manager of this company was tried a new product. The owner of company gave compliment to his manager that "company faced a loss but m happy to feel that the employees of my company putting their efforts to find something new for company".

**Isolation at work place:** A sense of isolation and alienation comes as a result of discord in the workplace. An individual may feel unsupported by his or her colleagues or employers in times of crisis. The individual may began to have self-doubts about his or her ability or competence. It can destroy trust between colleagues. Large level organisational employees feel this type of stress (Sherraden *et al.*, 2014). Chadha (2000) found that majority of teachers (84 per cent) of three universities experience low level of stress while 16 per cent bear moderate stress level. It was also found that the key role stressors in case of university teachers are role erosion, role isolation, inter-role distance and resource inadequacy.

**Physical work environment (noise, air quality and crowd):** Qualities of physical work environment and technology as a factor can cause stress in work setting. The physical qualities of work environment such as noise, lighting, temperature, crowded work place can cause direct sensory and physical stress and indirect psychological stress through their potentiality for causing negative health consequences and deterioration in job performance. Heavy travel demands or long-distance commuting are other aspects of jobs that employees may find stressful. Poor working conditions, excessive travel and long hours all add up to increased stress and decrease the performance. For example we can see in the various non-profit organisations like Kisan Sabha, Bharti Kisan Union and other farmers groups which do not have proper physical structure and basic facilities. They tolerate high temperature, travelling on their own body. The next issue is related with some public organisations where physical environment is not facilitative for good performance. Even the infrastructure of the organisations is in damaged condition, we can think about various government hospitals and education organisations. In the public organisations we could think about the extension personnel which travel a long distance to meet farmers. (Gupta, 2015) also reported that physical working

conditions are causing stress i.e. noise, insufficient lighting, low or high temperature, less space more employees, badly managed working environment, improper circulation of air, poor plan of office building and lack of basic facilities. These stressors are causing stress in an organization.

**Technological gap:** It is the cause of stress mainly in public sector. With the rise of technology the government makes the policies about enforcement these technologies but the employees which are older one sometimes not familiar with these types of technologies. Like in past years the government start use of computers to communicate circulars or other purposes in police department but old employees of department are not feeling comfortable with this. They are dependent on newly recruited employees. This makes stress even in little tasks like inquiries response by e-mail. Gothoskar (1999) also reported that technological advancement has increased the feeling of insecurity amongst the employees because beforehand training was not provided to the employees but computerization was introduced in each and every department. It is also explained that private banks are having higher workloads due to technology revolution, manpower reduction etc.

**Unavailability of resources:** It is also experienced by the public sector where the policies are made to use new technologies but proper resources are absent from the work place. For example unavailability of computer accessories in Punjab education board to provide basic computer educations in the government schools. Uritkhinbam (2013) also reported that financial problems of the institutes, resource inadequacy, lack of infrastructural facilities, lack of feedback and high expectations affects the organisation and create stress among the employees..

**Interpersonal relations at work:** “The quality of interpersonal relationship at work plays a dominant role in determining employee's job behaviour and job stress” (Chan & Qiu, 2011). Good relations form the social support and buffer the job stress where as poor relations at work is a threat for the employees. Relationship with superiors is equally important in determining the amount of job stress. For example this type of stress is mainly seen in the clerical employees. They people suffers from intrusions by others-interruption from noisy co-workers, ringing telephones. Office politics also may create stress for managers and employees. In other words, interpersonal relationships can be either a source of stress, or the social support that helps employees to cope with stressors. Gupta (2015) reported that around 3.2 per cent to 4.8 per cent of the female banker's respondents were stressed always due to strained relations with the superior, non-cooperative colleagues, strained relations with colleagues etc.

**Political pressure:** It is also a cause of stress mainly in public organisations. Sometimes pressure from above hierarchy may disturb the whole organisations like at the

time of elections the education organisations and department of police are the department which feel stressed till the election end. Nowack & Kenneth (2000) reported that political factors are those extra organisational factors which normally affect the output of organisation.

**Corruption:** it is the common cause of stress for every type of organisation. Any employee of organisation if found corrupt it may cause stressful situation to whole organisation. Other condition may be if employee who is corrupt will not prepare his agendas/work report honestly which causes stress for the next level employee to found out that surprising report.

### **COPING MECHANISM**

Coping is an activity to seek and apply solutions to stressful situations or problems that emerge because of stressors. Actually, the term 'coping' is more associated with 'reactive coping', because in general, coping as a response to a stressor. While coping mechanisms are brought about by a person's conscious mind, it doesn't mean that all of them bring about positive coping, there are some types of coping mechanisms which are maladaptive. Maladaptive coping is also synonymous to 'non-coping' like smoking, drinking etc (Woolfolk & Lehter 1984).

#### **Different types of coping mechanisms to stress are:**

**Physical mechanism:** In the past, daily work was largely physical. People forgot their tensions when they engaged in physical activities. Now that physical work is eliminated by the development of technology. For example if in old times there was a stressful situation appeared in work place then when a person goes to home from office, he goes on bicycle and in the way he seen various natural views which give him relaxation and peace to his mind. But in modern era if same situation in office, person goes to home in car by closing the mirrors and concentratly think about the stressor of work place. So, people need to develop a regular exercise program to reduce the effects of stress before it becomes harmful. Walking, Running, Yoga, Eye Comfort Exercises, Eye Movements, Focus Change, Time spend with nature, Deep breathing etc could be try.

**Time management:** One of the principle sources of stress is poor time management. Identifying the potential causes of poor time management and addressing them in time helps a great dealing reducing stress. For example:

- ❖ Preparing a daily-list of activities
- ❖ Proper arrangement
- ❖ Prioritize our work
- ❖ Distinguished between urgent and important work
- ❖ Take short brake in between and pace yourself
- ❖ Do not allow others to become “stealer” of your time
- ❖ Allocate time for relaxation
- ❖ Do not shuffle paper too much and act on them

**Being Assertive:** Being assertive involves standing up for

one's personal rights and expressing ones thoughts, feelings and beliefs directly, honestly and spontaneously in ways that do not infringe the rights of others. If managers want to be assertive but are concerned that others may find them too aggressive, here are some recommendations for turning aggressive behaviour into assertive behaviour.

- Give others a chance to speak
- Establish eye-contact with the other person
- Respect other's opinions
- Use appropriate body language
- Use assertive and not aggressive language
- Be clear, concise and to the point (Bridger *et al.*, 2013)

**Balancing work and personal time:** Balancing between work and personal time is indeed a tight rope walk. Any skew will oily result in problems, like time pressures, family work conflicts, guilt, etc. Following strategies that can help managers maintain a good balance between work and personal life:

- Learn how to set limits and stick to them
- Taking advantage of our workplace's family-friendly policies and supports
- Prioritize our multiple roles.
- Reduce the psychological conflicts we experience between work and personal life.
- Protect each role from interference by the others.
- Developing management skills (Elloy & Patil, 2012)

**Social support network:** Every person should have social support or people to talk. Good friends become highly supportive during times of stress and crises. Social network includes friends, family or work colleagues. Expanding your social support system can be a means for tension reduction because friends are there when needed and provide support to get the person through stressful situations.

**Organisational way to cope with stress:** Organisations should aware about the stress factor right from recruitment of the individual in the organisation. We can classify these as follows:

**Selection and placement:** Right selection of individual is very important for good work results. Selection of qualified individual and his placement according to his personality relation with stress work is important. Some individuals are more sensitive to stress situations should not put on jobs which are more stressful. Some individuals are less prone to the stress may adapt better to high stress jobs.

**Participative decision making:** If the organisation gives the chance to employee to make those decisions which are directly related with them and their job performance, it can increase the employee's control over his work and reduce the stress.

**Delegating:** Delegation is the downward flow of formal authority-from superior to subordinate. Why are some

managers not in favour of delegating responsibility□  
Because:

- They feel that employees can never do anything as well as they can.
- They fear that something will go wrong if someone else takes over a job.
- They lack time for long-range planning because they are hogged down in day to-day operations. Besides, delegating also teaches a manager to communicate persuasively, supervise and expand his/her sphere of influence. (Sharma & Krishna, 2011).
- Decentralised decision making is necessary for stress free organisational environment.

**Improved communication:** Sometimes due to lack of effective communication from the superiors, the employee does not know what they have to do and how they have to do. Effective communication with the employees reduces the uncertainty by making proper understanding about the work.

**Feedback:** So by improving the communication superior could take feedback from his sub-ordinates about requirements, strength and weakness of the given task and become able to provide the same.

**Personal wellness programmes:** These programmes focus on the employee's total physical and mental conditions. Organisations can provide the facilities for physical fitness such as gyms, swimming pools, tennis courts etc. as well as psychological counselling. Organisations should hold seminars or workshops to make the employees understand sources of stress and the possible ways to reduce it (Gupta & Joshi, 2011).

**Stress Committee in the organization:** should be made which could yearly examine the physical wellness of employees and stress related problem in the organisation. Other important task is improvement in physical work environment of organisation.

**Training programme:**

**Educational programme for personnel for importance of organisational objective especially in commercial and social responsibility about the job:** These types of training programmes make a sense of responsibility in employee's mind toward the organisation's objective. It enables the employee to understand that how important their role is toward organisation successes.

**Stress training:** This refers to the training courses designed to provide employees with improved coping skills such as meditation, muscles relaxation and stretching techniques combining with nutritional awareness and techniques of coping of tension, headaches and backaches. Fresh fruits should be available in the meetings and training seminars.

**Family training:** Exposing the child to real life situations right from beginning. For example if the child faced small kind of stress situations right from beginning like adjustment in less money in hostel then it would be beneficial for him in financial stress at any time in his life.

### Exposing the employee to different situations:

Organisation should expose its employees to every situation which could be appeared in it. For example in the military there are late night parties which they have to attend and again in early morning they are present in the morning prate. Actually it is a practice for the war situation where they continuously engaged with work.

### NEGATIVE METHODS OF REDUCING STRESS WHICH SHOULD BE AVOIDED

- Taking sleeping pills
- Drinking alcohol
- Smoking
- Having tea or coffee more frequently
- Overeating

**THE 5 R'S OF STRESS:** There are 5 core concepts which are used in the reduction of anxiety or stress: (Source: Panchanatham *et al.*, 2006)

- Recognition of the causes and sources of the threat or distress; education and consciousness raising.
- Relationships identified for support, help, reassurance
- Removal from (or of) the threat or stressor; managing the stimulus.
- Relaxation through techniques such as meditation, massage, breathing exercises, or imagery.
- Re-engagement through managed re-exposure and desensitization.

### Strategies to reduce the stress

1. Creating awareness among employees regarding various stress management techniques.
2. Professional capabilities of the senior scientists should be freely utilized to train the junior staff by involving the seniors and retired scientists.
3. There is need to follow appropriate work related techniques such as keeping of essential items on desk, master to-do list, coding of files, maintaining work schedule and time management to reduce the work pressure on the scientists which causes stress to a great extent and scientists should be motivated to follow the stress management techniques such as body therapy techniques like body messaging, acupressure, acupuncture and spa etc. Water therapy, meditation and relaxing exercises should be made a compulsory part of daily routine of every individual.

### CONCLUSIONS

It can be concluded that common causes of stress in organization are role ambiguity, role conflicts, role-overload, lack of participation in decision making, ineffective communication, interpersonal relationships which resulted poor performance and productivity of the

organization. Stress effects are expensive both for organization and for individuals. Effective management of stress could be achieved under different techniques. So to be more effective, organizational members must recognize how to manage stress using different techniques such as proper time management, physical, diversion, organisational techniques. Organizations authorities must change or remove the stressors by redesigning the works and training programmes on stress to give individuals more control over their work activities and stress.

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## Role of MGNREGS in Employment Generation, Wage-Income and Assets Created in different States of Rural India: A Source for Doubling Farm Income

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### ABSTRACT

The present study was conducted with the main objective is to examine the extent of job card holders, employment generation pattern, wage rates, expenditure on agriculture and allied activities, works completion rate and assets created through MGNREGS works. The secondary data was available at official website of MGNREGS which was used for analysis purpose. The performance of scheme with state-wise data indicates presence of variations in job card holders with regard to all socially disadvantaged groups. Average person-days of employment per household initially increased to 45 but later decreased to 42 mandays in study period. MGNREGS and agricultural wages were observed to be positively correlated with each other. Kerala, Tamil Nadu, Andhra Pradesh, Uttarakhand had the highest whereas Nagaland had the lowest percentage share in expenditure towards agriculture and allied agricultural activities. Percentage of work completion rate in overall terms was found to be significantly highest in Kerala, Tamil Nadu, and West Bengal, while Assam had the lowest rate. Percentage of assets created in public works was highest in Haryana, followed by Himachal Pradesh, Tamil Nadu, Tripura, and the lowest in Manipur. The CAGR of assets created from 2012-13 to 2015-16 showed positive growth in states like Andhra Pradesh (0.72), Kerala (0.42), Tamil Nadu (0.11), whereas negative growth in this regard was reported in Bihar (-0.14), Chhattisgarh (-0.5), Jammu and Kashmir (-0.17). The findings points towards importance and role of non-farm/wage income employment opportunities under MGNREGS because it creates a good buffer, benefiting the Indian agriculture particularly farming community like small and marginal farmers during lean season as a reliable source of supplementary income. Thus, MGNREGS can play a significant role in achieving the goal of doubling the farm income in rural India.

### Keywords

Doubling farm income, employment, MGNREGS, wages

### JEL codes

D63, E24, H55

### INTRODUCTION

The enactment of scheme has created immense potential in research as it constitutes largest workforce in history of social security programme in the world. Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) was notified on 7 September 2005. The mandate of the Act is to provide 100 days of guaranteed wage employment in a financial year to every rural household whose adult members volunteer to do unskilled manual work. The Act came into force on 2 February 2006 and was notified in 200 districts in the first phase with effect from February 2nd 2006 and then extended to additional 130 districts in the financial year 2007-2008; the remaining districts had been notified

under the NREGA with effect from April 1, 2008. It is the first transaction-based real-time system for any public works programme in the country that is available in the public domain. There has been a digitization of all the processes in MGNREGS, right from a worker registering demand for work, to work allotment, to finally getting wages for completed works (Anonymous, 2012).

Over the past ten years of implementation various trends has emerged at national level so far in which scheme covered 682 districts, 6860 blocks, 2, 62,251 Gram Panchayats, 12.5 crore job cards issued, and the total number of workers was 26 crore in which 11 crore was the total number of active workers, had generated large quantum of employment provided to SC (21 per

cent) and ST (16 per cent) workers, and women (49 per cent) are worked in the scheme. Person-days generated so far since inception was about 2, 221 crore, 40 crore household were provided average days of employment, total expenditure was about 3, 67,175 crore, then 11 crore accounts of active workers are opened in bank and post offices, 94 per cent of wages were credited into accounts of workers through EFM system with ₹152 and ₹203 as average wage rate and cost per day per person. The total central release was about 2, 78,197 crore. Thus there are significant achievements in implementation process of the scheme ([www.nrega.nic.in](http://www.nrega.nic.in)).

The linkage of the MGNREGS with agriculture is in-built in the legislation. Around 140 kinds of permissible works are carried out where states have adopted them as per local needs like rural connectivity, land development and soil conservation, water harvesting, irrigation provisioning, drought proofing, horticulture, tree-plantation. Works under the MGNREGS can be taken up on both community and private lands. Small and marginal farmers, SC/ST and IAY beneficiaries are eligible for taking up works on their own lands (MoRD, 2014). Different studies have pointed out that MGNREGS wages helpful in purchasing farm inputs, investments are made in small ruminants, like poultry and there has been a shift towards diversified, high value and more remunerative crops from traditional staples, credit worthiness and repayment capacity for agricultural loans has been improved. Farmers earn income from various sources, viz-a-viz crop cultivation, horticulture, dairy, poultry, fisheries, other allied activities in such a situation, Employment opportunities under MGNREGS create a good buffer, benefiting the farming community during lean season as a reliable source of supplementary income MGNREGS has acted as a safety net during drought affected regions for the marginalized section of the rural society. Works implemented under the MGNREGS on the SC lands have brought change in cropping system and cropping pattern (Anonymous 2014). A good number of assets had been created in scheme which improved rural infrastructure specifically wells, that laid the foundation for improvements in agricultural production, increased income and better livelihood security. MGNREGS wells had given 5.3 per cent of average rate of return on the total cost of construction of the wells and their average rate of return on the public expenditure for construction of wells was about 6.34 per cent in which a investment of ₹100 on a well, on average, reaps a return of ₹5.3 per annum (Anonymous 2015). This is a positive step in the direction of moving from unskilled manual labour to skilled farming practices and meeting twin benefits i.e., income through lean season employment and increased land productivity for marginal and small farmers (MoRD, 2012). In this background the present paper helps in understanding role of MGNREGS in supplementing employment, wage-income and assets creation in rural India - with special reference to agriculture and its allied

**Table 1: State-wise number of MGNREGS job card holders, 2012-2015**

States	(Lakhs)			
	2012-13	2013-14	2014-15	2015-16
Andhra Pradesh	144.31	150.32	91.55	83.77
Arunachal Pradesh	1.81	1.9	1.98	2.08
Assam	40.11	41.16	42.83	45.86
Bihar	130.83	130.12	126.83	132.36
Chhattisgarh	43.78	39.91	39.42	39.02
Gujarat	38.22	34.36	34.78	34.95
Haryana	7.48	7.79	7.73	7.67
Himachal Pradesh	11.47	11.6	11.61	11.73
Jammu and Kashmir	10.78	11.44	11.67	12.19
Jharkhand	40.05	37.38	36.03	36.8
Karnataka	54.64	55.58	55.2	55.78
Kerala	25.42	28.22	30.15	31.91
Madhya Pradesh	119.38	99.44	84.59	78.84
Maharashtra	70.91	72.52	76.24	78.25
Manipur	4.78	5.07	5.24	5.38
Meghalaya	4.67	4.76	4.8	4.87
Mizoram	2.01	1.96	1.8	1.86
Nagaland	3.98	4.13	4.24	4.25
Odisha	63.05	63.58	65.08	66.69
Punjab	9.22	10.69	10.94	11.76
Rajasthan	99.45	98.3	98.46	99.35
Tamil Nadu	92.28	84.97	82.25	84.28
Tripura	6.42	6.32	6.3	6.12
Uttar Pradesh	151.13	149.11	152.66	160.97
Uttarakhand	10.55	10.71	11.09	11.35
West Bengal	114.61	117.43	119.97	123.09
<b>All India level</b>	<b>1301.34</b>	<b>1278.77</b>	<b>1213.44</b>	<b>1231.18</b>
<b>C.V</b>	<b>19.40</b>	<b>19.40</b>	<b>18.74</b>	<b>18.91</b>

Source: [www.nrega.nic.in](http://www.nrega.nic.in)

activities, which plays significant role in achieving goal for doubling farm income.

#### DATA AND METHODOLOGY

The present study was mainly based on secondary data which was sourced from official website of MGNREGS helps to analyze the role of scheme in achieving the goal of doubling the farm income through employment generation, wage-income and assets created in different states of rural India during 2012–13 to 2015–16. State-wise data related to job cards, employment generation through average person-days and household attaining 100 days of employment, average wages, expenditure on agriculture and its allied activities, average number of completed works related to agriculture and drought activities, work completion rate and assets created was taken into consideration. The data was analysed using percentages, coefficient of variation and CAGR over the period of time in order to achieve the stipulated objective of the study.

#### RESULTS AND DISCUSSION

##### State-wise coverage of job cards

The state-wise data depicted overtime in the Table 1,

clearly underscore the facts that there was a wide variation in the proportion of job cards issued to the household registered. The scenario shows that highest job cards were issued in the Bihar, West Bengal, followed by Uttar Pradesh whereas north eastern states which constitutes lowest proportion. However the number of households applied for job cards varied significantly across different states. The overtime variations of job card holders with regard to all socially disadvantaged groups in India are measured on the basis of value of coefficients of variations. The value of C.V came out as 19.40 (2012-13) and 18.91 (2015-16). This indicates that an overtime variation in terms of job cards issued was relatively more consistent in India.

### Employment Generation

It is one of major objective of scheme to enhance livelihood security of the people in rural India. The average person-days of employment per household, in

terms of percentage showed higher average mandays generated in Andhra Pradesh, Tripura, Mizoram, Sikkim, Kerala, Maharashtra, Rajasthan and Tamil Nadu whereas Punjab, Bihar and Jammu and Kashmir showed lowest employment generation. However state-wise households attaining 100 days of employment despite making provision of 100 days employment per year indicates that all most all states attained more below than 100 days that showed there was large deviations are present. Andhra Pradesh, Tamil Nadu, and Rajasthan are showed attainment of 100 days of employment per household crossing two digits level under scheme during the period between 2012 to 2015 (Table 2).

### Wage-Income pattern under MGNREGS

From the Table 3, data reveals that wage rates offered in scheme was highest as increased trend for over a period of time was observed in Goa, Haryana, Punjab, Kerala, and Karnataka whereas lowest wage rates in Andhra

**Table 2: State-wise extent of annual household employment pattern under MGNREGS, 2012-2015**

States	Avg. person days	HH with 100 days (per cent)	Avg. person days	HH with 100 days (per cent)	Avg. person days	HH with 100 days (per cent)	Avg. person days	HH with 100 days (per cent)
	2012-13		2013-14		2014-15		2015-16	
Andhra Pradesh	58.83	14.72	53.14	12.03	43.61	14.02	46.68	12.37
Assam	25.44	0.22	23.68	0.36	20.99	0.45	28.84	1.15
Bihar	43.32	3.34	41.78	2.75	32.87	1.60	41.86	2.00
Chhattisgarh	45.04	5.32	51.64	7.84	31.76	2.73	36.77	4.65
Goa	13	0.00	22.9	0.00	22.21	0.00	15.58	0.00
Gujarat	41.31	1.16	39.79	0.67	34.44	0.82	35.14	0.41
Haryana	43.57	0.43	36.26	0.32	27.15	0.25	27.89	0.12
Himachal Pradesh	48.67	0.73	52.34	1.26	39.92	0.93	40.17	0.63
Jammu & Kashmir	48.93	0.72	50.94	1.47	33.08	0.20	35.97	0.35
Jharkhand	39.5	1.82	38.3	1.56	38.96	3.89	45.44	4.01
Karnataka	46.48	2.43	49.56	2.67	38.8	2.07	42.41	2.62
Kerala	54.83	7.57	56.83	9.23	37.54	2.73	41.96	2.18
Madhya Pradesh	36.1	2.67	42.19	3.95	41.56	8.61	42.02	6.00
Maharashtra	52.66	4.73	45.18	2.76	50.22	8.11	52.44	5.54
Manipur	37.13	0.01	24.82	0.00	19.58	0.00	10.33	0.00
Meghalaya	44.77	0.68	56.76	1.08	40.19	0.80	39.31	0.42
Mizoram	73.24	0.09	70.55	0.00	19.29	0.00	46.21	0.00
Nagaland	35.1	0.00	42.92	0.02	16.29	0.00	40.77	0.00
Odisha	34.11	1.70	41.61	3.56	33.82	3.21	37.48	3.80
Punjab	27.08	0.08	32.67	0.28	21.49	0.09	26.31	0.19
Rajasthan	51.9	9.10	50.85	10.13	43.95	12.91	48.57	10.94
Sikkim	60.79	0.21	68.91	10.13	39.62	0.13	50.06	0.11
Tamil Nadu	57.82	30.11	58.59	20.66	43.42	11.85	49.55	12.56
Tripura	86.78	5.25	87.69	6.52	77.08	6.80	88.32	8.83
Uttar Pradesh	28.2	1.45	34.96	3.56	31.3	4.23	31.04	3.67
Uttarakhand	39.96	0.28	41.28	0.61	29.11	0.25	33.02	0.40
West Bengal	33.66	5.04	37.44	6.37	30.63	6.05	38.32	7.85
<b>All India level</b>	<b>44.63</b>	<b>100.00</b>	<b>45.92</b>	<b>100.00</b>	<b>37.74</b>	<b>100.00</b>	<b>41.95</b>	<b>100.00</b>

Source: [www.nrega.nic.in](http://www.nrega.nic.in)

Table 3: State-wise extent of average wages paid under MGNREGS, 2012-2015

States	2012-13	2013-14	2014-15	2015-16	Minimum agricultural wages
	MGNREGS Wages (₹)				
Andhra Pradesh	105.58	112.75	121.25	131.67	170
Arunachal Pradesh	123.75	134.75	151.50	167.08	155
Assam	135.92	151.67	167.00	178.92	110
Bihar	144.00	154.25	170.75	176.92	120
Chhattisgarh	130.25	143.75	153.92	153.67	120
Goa	144.42	178.00	195.25	204.50	100
Gujarat	119.25	132.83	150.75	157.83	120
Haryana	191.83	215.17	238.50	253.00	180
Himachal Pradesh	129.17	137.67	153.33	160.67	160
Jammu and Kashmir	130.67	144.33	155.67	163.50	120
Jharkhand	122.00	138.00	158.00	162.00	130
Karnataka	153.75	172.50	190.33	203.25	150
Kerala	163.75	180.00	213.83	231.75	220
Madhya Pradesh	128.00	139.75	150.17	150.50	130
Maharashtra	161.33	161.08	166.67	178.50	120
Manipur	143.92	140.25	174.33	189.17	130
Meghalaya	127.67	145.25	152.75	162.75	110
Mizoram	113.33	148.00	99.17	183.00	175
Nagaland	124.00	135.00	154.58	167.00	160
Odisha	125.00	141.75	161.92	182.83	100
Punjab	163.83	182.00	198.08	205.75	170
Rajasthan	101.50	109.67	115.08	119.50	150
Sikkim	125.08	136.25	155.58	168.42	100
Tamil Nadu	96.67	104.42	125.33	133.67	150
Tripura	124.00	132.75	150.17	158.58	120
Uttar Pradesh	124.42	141.42	155.17	160.92	120
Uttarakhand	124.83	141.83	155.67	161.00	140
West Bengal	136.50	146.58	164.08	170.00	175
<b>All India level</b>	<b>122.58</b>	<b>133.17</b>	<b>148.33</b>	<b>153.66</b>	<b>134</b>

Source: [www.nrega.nic.in](http://www.nrega.nic.in)

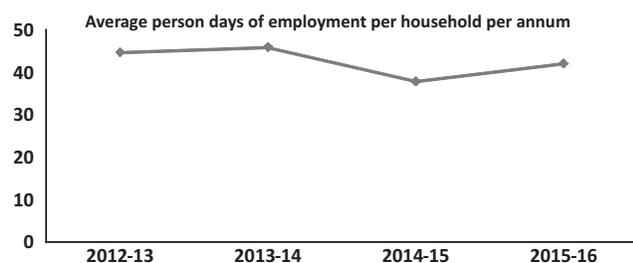


Figure 1: National level total average person days of employment per household

Pradesh, Tamil Nadu and Madhya Pradesh. It was noticed that minimum agriculture wages was fixed at ₹134 per day and it varies at all India level. Similarly, Haryana government had been paying highest wages under MGNREGS increased from ₹192 per day in 2012 to as high as ₹253 per day in 2015; Kerala also paid highest wages in agriculture during the same period. Thus on

these data we can say that increase in share of labour cost is due to continuous increase in minimum wage rate for agricultural labourers and this due to increased in MGNREGS wages every years, and they are observed to be positively correlated with each other.

#### Expenditure pattern under MGNREGS

Further analysis drawn from Table 4, revealed that inter-state variations which address the perceptions regarding expenditure pattern of scheme. Kerala, Tamil Nadu, Andhra Pradesh and Uttarakhand had highest percentage share in expenditure towards agriculture and allied agricultural activities, whereas north eastern states like Nagaland, Mizoram and Assam constitutes lowest percentage. Further it was noticed that proportion of expenditure on agriculture and activities and its allocation was increased from 56 per cent in 2012 to as high as 63 per cent in 2015. Hence there was a positive impact on agriculture such as livelihood diversification, increased cropping intensity and multi-cropping/dual cropping,

**Table 4: State-wise proportion of expenditure on agriculture and allied agricultural activities to total expenditure under MGNREGS, 2012-2015**

States	(In per cent)			
	2012-13	2013-14	2014-15	2015-16
Andhra Pradesh	76.18	73.68	76.65	77.82
Arunachal Pradesh	56.37	46.55	44.1	42.19
Assam	34.54	34.92	35.13	35.37
Bihar	42.66	43.58	43.78	44.09
Chhattisgarh	53.91	53.91	54	53.93
Goa	66.42	63.33	63.73	64.33
Gujarat	63.55	61.9	60.54	60.98
Haryana	54.53	53.87	54.36	54.96
Himachal Pradesh	62.35	66.25	67.95	68.78
Jammu & Kashmir	54	53.88	53.76	53.57
Jharkhand	67.49	67.4	67.09	66.99
Karnataka	76.21	75.04	73.63	73.44
Kerala	97.19	97.43	97.38	97.48
Madhya Pradesh	63.1	61.49	61.86	62.08
Maharashtra	69.99	69.46	68.5	69.25
Manipur	46.76	46.39	46.99	48.72
Meghalaya	32.85	33.1	33.26	33.37
Mizoram	14.65	15.91	21.09	33.63
Nagaland	19.17	18.23	17.81	18.57
Odisha	33.26	34.44	34.86	35.76
Punjab	59.24	58.57	58.12	57.09
Rajasthan	50.36	51.44	51.46	51.58
Sikkim	64.84	61.11	60.19	60.5
Tamil Nadu	82.73	84.2	83.48	82.56
Telangana	85.45	85.45	57.95	61.63
Tripura	55.05	55.56	57.97	60.19
Uttar Pradesh	41.15	39.56	38.76	39.65
Uttarakhand	87.98	84.18	81.5	79.22
West Bengal	55.21	56.36	57.7	58.51
<b>All India level</b>	<b>56</b>	<b>49</b>	<b>53</b>	<b>63</b>
<b>Total expenditure (crores)</b>	<b>39,779</b>	<b>38,553</b>	<b>36,026</b>	<b>43,908</b>

Source: www.nrega.nic.in

which has improved the livelihood security of beneficiary households.

**Public works (Agriculture and Drought related) undertaken MGNREGS**

The works undertaken at scheme with special reference to agriculture and drought related activities was mostly related to water conservation and water harvesting, micro irrigation, drought proofing, provision of irrigation facility to land owned by farmers, fisheries etc. In fact growth of agriculture sector mainly depends on irrigation facilities, therefore the average estimates relating to different works undertaken across states are provided in foremost priority under MGNREGS (Table 5).

**Table 6: State-wise extent of work completion rate since inception of the scheme, 2006-2015**

States	(Per cent to total allocated works)			
	2013-14	2014-15	2015-16	Overall
<b>Work completion rate</b>				
Andhra Pradesh	76.92	79.86	64.33	66.14
Arunachal Pradesh	70.67	64.02	23.45	45.39
Assam	91.58	44.98	4.91	61.07
Bihar	88	68.06	12.51	65.27
Chhattisgarh	98.09	89.24	32.31	72.74
Goa	66.28	69.61	58.74	62.77
Gujarat	96.39	90.82	52.43	76.70
Haryana	99.00	96.24	31.41	84.42
Himachal Pradesh	98.6	88.97	54.11	86.53
Jammu & Kashmir	92.61	76.05	34.68	76.16
Jharkhand	98.87	85.98	50.62	81.22
Karnataka	96.46	90.65	38.92	71.28
Kerala	99.04	96.86	81.69	86.94
Madhya Pradesh	96.32	88.6	55.91	89.41
Maharashtra	83.17	62.41	27.91	62.46
Manipur	92.62	90.86	89.11	78.55
Meghalaya	97.12	93.78	71.12	80.61
Mizoram	99.99	99.54	97.33	91.39
Nagaland	96.71	97.67	92.75	85.83
Odisha	90.58	67.53	37.09	64.52
Punjab	97.39	85.01	45.12	71.42
Rajasthan	93.52	70.6	17.11	73.16
Sikkim	100.00	100.00	14.07	70.47
Tamil Nadu	99.79	98.81	86.86	89.23
Telangana	93.06	66.69	38.51	72.91
Tripura	99.09	99.44	80.87	88.11
Uttar Pradesh	94.39	74.97	35.81	79.20
Uttarakhand	99.39	82.14	39.08	64.72
West Bengal	96.18	77.25	21.10	57.74
<b>All India level</b>	<b>90.43</b>	<b>73.61</b>	<b>36.75</b>	<b>73.24</b>

Source: www.nrega.nic.in

Among various activities provision of irrigation facility to land owned by farmers accounted maximum share in total works undertaken and was highest in Uttar Pradesh, West Bengal, Rajasthan, Madhya Pradesh followed by north eastern states had lowest and uncompleted almost zero works. Madhya Pradesh, West Bengal, Jharkhand constitute the highest number of completed works in water conservation and water harvesting areas compare to lowest in north-eastern states. Micro Irrigation Works had highest number in Andhra Pradesh followed by Uttar Pradesh whereas Mizoram had lowest. Drought proofing was highest in drought affected areas like Maharashtra, Karnataka Bihar, Madhya Pradesh, Uttar Pradesh, and Manipur had lowest. Fisheries had highest number of completed works in coastal regions and almost in north eastern states. All these variations occurs because, at each level decisions and interpretations by the actors/MGNREGS officials create nonsystematic

Table 5: State-wise average total no of completed agriculture and drought related works, 2012-2016

States	Water conservation and water harvesting	Micro irrigation works	Drought proofing	Provision of irrigation facility to land owned by farmers	Fisheries
Andhra Pradesh	13401	28588	2408	1616	5
Assam	451	460	3306	2458	63
Bihar	2764	2483	13876	2006	11
Chhattisgarh	5183	900	2011	16693	2
Gujarat	3568	194	2441	5756	4
Haryana	726	1572	197	68	0
Himachal Pradesh	6426	2411	689	7442	3
Jammu and Kashmir	917	2051	54	23	2
Jharkhand	26228	647	554	10438	0
Karnataka	9274	2887	6376	18314	32
Kerala	15502	6298	2245	9797	1
Madhya Pradesh	27139	254	15563	49902	32
Maharashtra	8971	334	6578	10489	16
Manipur	17	52	8	16	0
Meghalaya	239	41	146	0	8
Mizoram	80	20	126	212	99
Nagaland	87	97	108	0	4
Odisha	8554	426	4766	14948	27
Punjab	70	415	597	3	3
Rajasthan	8228	2324	1942	13763	0
Sikkim	44	32	137	50	0
Tamil Nadu	6869	4595	485	6179	116
Tripura	6370	6058	2113	263	813
Uttar Pradesh	16358	15264	17198	60109	2
Uttarakhand	1459	1767	1473	555	5
West Bengal	23608	9424	48441	26353	14
<b>All India level</b>	<b>1,92559</b>	<b>77,879</b>	<b>1,03362</b>	<b>2,32169</b>	<b>1,246</b>

Source: [www.nrega.nic.in](http://www.nrega.nic.in)

variations in terms of selection of works, estimation and execution of works and relevance for beneficiaries.

#### Work completion rate under MGNREGS

As per the latest estimates in terms of percent to total allocated works, Table 6, showed about perceptions regarding ongoing and completed works over past ten years of implementation. Percentage of work completion rate is arrived by dividing the number of works completed over not yet completed and multiplied by 100; rate is obtained over the years. Kerala, Himachal Pradesh, Madhya Pradesh, Nagaland, Mizoram, and Tamil Nadu, has recorded highest work completion rate while Arunachal Pradesh, West Bengal and Assam has recorded lowest works completion rate. Thus performance of different states in completed works has been good in terms overall percentage rate except few states.

#### Assets created under MGNREGS

From the Table 7, results showed that percentage of assets created shows that Rajasthan, Himachal Pradesh, Tamil Nadu, and Tripura, had recorded highest

percentage. Chhattisgarh, Jharkhand and Manipur, had lowest. The CAGR showed positive growth in states like Andhra Pradesh (0.72), Kerala (0.42), Tamil Nadu (0.11), Assam (0.27), whereas negative growth was reported in Bihar (-0.14), Chhattisgarh (-0.5), Jammu and Kashmir (-0.17). The growth in MGNREGS works mainly depends on total taken up over total works completed, in which state government play important role in hierarchy level bureaucracy in implementation process. Thus performances of states in assets creation are better and good in terms of percentages arrived except few minor states.

#### CONCLUSIONS

Based on the results obtained, MGNREGS is the most comprehensive; demand based legal frame work promised on open ended budget for implementation unlike all other allocation-driven social sector scheme. The study makes broad assessment in successful performance of MGNREGS during 2012 to 2015 and identifies major concerns which cover entire states across

**Table 7: State-wise proportion of assets created to total allocated public works, 2012-2015**

States	Assets created (per cent)					CAGR
	2012-13	2013-14	2014-15	2015-16	Overall	
Andhra Pradesh	5.63	6.47	2.25	0.65	45	0.72
Assam	29.84	22.35	19.69	11.38	83	0.27
Bihar	13.03	15.21	13.05	23.6	65	-0.14
Chhattisgarh	44.49	25.94	17.35	7.72	16	-0.55
Gujarat	34.6	22.8	25.11	8.81	91	0.41
Haryana	31.2	32.46	20.75	41.71	86	-0.07
Himachal Pradesh	33.89	38.84	30.8	39.62	93	-0.04
Jammu and Kashmir	8.36	14.29	1.84	17.95	42	-0.17
Jharkhand	34.38	31.61	28.64	32.1	27	0.02
Karnataka	12.21	11.6	9.1	21.68	55	0.13
Kerala	60.97	30.66	8.82	15.1	86	0.42
Madhya Pradesh	27.02	25.39	36.01	29.75	88	-0.02
Maharashtra	6.31	13	25.81	16.92	62	-0.22
Manipur	2.64	7.16	2.4	0.99	13	0.28
Meghalaya	9.46	8.71	1.83	4.79	25	0.19
Mizoram	24.36	29.36	43.9	35.78	33	-0.09
Nagaland	1.77	16.69	6.7	15.41	41	-0.42
Odisha	25.61	25.67	16	17.01	84	0.11
Punjab	36.35	26.45	18.44	21.84	53	0.14
Rajasthan	22.92	20.48	38.44	14.25	96	0.13
Sikkim	21.77	15.29	12.16	13.29	63	0.13
Tamil Nadu	54.95	32.64	30.66	35.83	94	0.11
Tripura	44.04	49.11	12.7	37.02	93	0.04
Uttar Pradesh	22.16	28.48	10.51	16.62	78	0.07
Uttarakhand	11.37	40.98	14.66	20.33	87	0.14
West Bengal	38.52	29.05	13.98	14.88	86	0.27
<b>All India level</b>	<b>20.41</b>	<b>18.34</b>	<b>14.52</b>	<b>15.58</b>	<b>87</b>	<b>0.10</b>

Source: [www.nrega.nic.in](http://www.nrega.nic.in)

India in terms of job cards, person days of employment generated, expenditure on agriculture and allied activities, works completion rate, a large number of works relating to water conservation and harvesting, micro-irrigation, indicate the assets created. However in 2012 about 1,302 Lakhs job cards was issued which appear significant higher proportions across states. The overtime variation of job card holders with regard to all socially disadvantaged groups in India is measured on the basis of value of coefficients of variations. The average person-days of employment per household increased to 45 mandays in 2012-13 but later decreased to 42 mandays in 2015-16. Average wage rates per person-day had been showing a rising trend over the years, and agricultural wages have also increased across the country over the same period. MGNREGS had been an important driving force behind this rising wage rates but the scheme doing better in expenditure on agriculture and allied sectors with increased allocation from 56 per cent to 63 per cent in reference period.

Percentage of work completion rate had highest in Kerala, Tamil Nadu, and North Eastern States but West Bengal and Assam has recorded lowest. Haryana,

Himachal Pradesh, Tamil Nadu, Tripura, and others recorded highest percentage in assets created. In this regard lowest was in Chhattisgarh and Manipur. The CAGR showed positive growth in Andhra Pradesh (0.72), Kerala (0.42), Assam (0.27), whereas negative growth was reported in Bihar (-0.14), Chhattisgarh (-0.5), Jammu and Kashmir (-0.17). Thus it indicates variations are present across different states due to presence of socio economic, political, agro climatic factors along with bureaucracy and other management-administration practices in implementation.

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## Dissection of Weather Parameters for Forecasting Oilseed Crops Yield

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### ABSTRACT

Most of the agricultural crops are sensitive to weather, particularly under Indian condition where monsoon play a key role in farming. Dissection of role of important weather parameters have become necessarily in the age when the effect of climate change has been expressing not only by the plants but also by the animals and human being. In the present paper we used multiple linear regressions, which is a simple linear regression analyses that is used to analyze the relationship between single response variable (rapeseed and mustered yield as a Dependent variable) with two or more controlled variables (minimum temperature, maximum temperature, rainfall as the independent variables). In this paper, stepwise multiple regressions have been used because this method is combination of forward selection and backward elimination method. The main objective of this paper is to select the suitable controlled variables to forecast the yields of oilseed crops (rapeseed and mustered) from 1958 to 2014 in India. The data about the yield was collected from handbook of statistics on the Indian economy (<http://dbie.rbi.org.in>) and for weather data of India from website [www.gov.data.in](http://www.gov.data.in), and data has been analyzed using SPSS 20.0.

### Keywords

Forecast, oilseed crops, regression analyses, stepwise multiple regression

### JEL Codes

Q10, Q19

### INTRODUCTION

India is one of the major oilseeds producing country in the world. In terms of area under cultivation India occupies 19 per cent of the total area under oilseeds in the world and it accounts for 10 per cent of the total oilseeds production in the world.

India has diverse agro-climatic conditions which are suitable for growing various oilseed crops and varieties. Nine major oilseeds crops which are grown in India are - Groundnut, Rapeseed Mustard, Sunflower, Sesame, Soybean, Safflower, Castor, Linseed and Niger. Apart from this two perennial oilseed crops namely Coconut and Oil palm are grown in this country. Moreover, there are more than 100 species of forest plants which can be utilized for producing edible oil in the country.

In India production of oilseeds is highly unpredictable because of the unstable nature of the Indian monsoon. As only 28 per cent of the total area under oilseed crops is irrigated most of the production is

from rain fed areas which show unpredictability in the production due to vagaries of the weather. This instability in the production of oilseed results in the volatility of the prices of the edible oils, which is a cause of worry for policy makers as average consumers spend a sizeable portion of their per capita income on buying edible oils. Oilseed is one of the most important crops throughout the world. Effect of different factors contributing to the yield of oilseed crops could help in improving productivity, especially concerning responses to climate change. There is little doubt that climate change will affect the yield of oilseed rape as well as of most other crops (Peltonen Sainio *et al.*, 2010). There have been few studies dealing with the effect of climate change on winter oilseed rape production in Europe. Tuck *et al.* (2006) estimated that the potentially suitable areas for oilseed rape production will increase in northern latitudes of Europe. Also, there have been several studies on effects of individual climatic factors

affecting winter oilseed rape production (Diepenbrock, 2000; Rathke *et al.*, 2006). Temperature is an important factor influencing both development and growth throughout the growth phases of oilseed rape (Rathke *et al.*, 2006). In cooler regions, resistance to low temperatures during winter is a determining factor. In such areas, rapidly growth of the crop due to high N availability, early sowing and warm temperatures might result in longer stems that enhance susceptibility to frost damages. There is a strong correlation between intercepted radiation and plant growth during spring and full flowering (Mendham *et al.*, 1981), and intercepted photo synthetically active radiation correlates well with crop yield. Drought stress during germination negatively affects crop establishment and subsequent growth (Rathke *et al.*, 2006), but long wet periods may lead to less favorable seed beds and thus reduce crop establishment.

Climate change is a major concern today and the researchers are engaged in understanding its impact on growth and yield of crops and also identifying suitable management option to sustain the productivity of crops under projected climate change scenario. Changes in seasonal temperatures affect the crop yield, mainly through their effect on phenological and developmental processes. Winter crops are especially vulnerable to high temperature during the reproductive stages and their differential responses to rising temperatures can have importance consequences for crop yield. Hence, an understanding of the responses of crops to temperature and fluctuation in other component of the weather is basic in evaluating the impacts of climatic scenario on crop yield. In many previous studies, yield forecasting models have incorporated a series of weather predictors [Kandiannan *et al.* (2002), Verma *et al.* (2003), Dadhwal *et al.* (2003)]. Models developed by Mehta *et al.* (2000) were successfully used for forecasting yields of various crops at district as well as agro climatic zone level in different states in India.

In addition, parameterization of process-based crop models is difficult and the use of inaccurate parameter estimates can increase prediction errors (Wallach, 2011). This research aimed to determine the prediction accuracy

between the oilseed crops yield and weather variables through stepwise regression.

**MATERIALS AND METHODS**

Here we aim to analyze the effects of the regression technique, of the temporal resolution of the climatic input data, and of the level of model complexity on the estimated effect of climate on total oilseed crops yield. For this purpose stepwise regression models are fitted to a large dataset of rapeseed and mustered oilseed crops yield, area and different climatic factors (minimum temperature, maximum temperature and annual rainfall) from 1958 to 2014 for India. In this study secondary data were collected from handbook of statistics on the Indian economy (<http://dbie.rbi.org.in>) and [gov.data.in](http://gov.data.in) and their results are used to estimate effects of climate changes on oilseed rape yields and to analyze the associated uncertainties.

To understand about the yield-biometrical factors relation across growth stages, multiple linear regression models were constructed for each of the stages, as below.

$$Y = Xb + e$$

where Y is the response vector of order (n×1), X is a matrix of order (n×k+1) with n rows corresponding to observations and k is a parameter vector corresponds to number of independent variables, of order (k+1) × 1 and e is the error component of y assumed to be a random variable with zero mean and constant variance across the values of x, assumed to follow normal distribution. Diagnostics for influential data point are an important part of the regression model builder's arsenal of tools.

There multiple linear regressions were used for development of weather yield models. The predictive ability of model were compared by fitting the weather models using (i) only two variables as a covariance, namely area, maximum temperature and (ii) expanding use of weather variables by adding two more weather variables one by one viz., minimum temperature and rainfall for the same period. The best subset of weather variables were selected using a stepwise regression method in which all variables first included in the model and eliminated one at a time with decisions at particular step conditioned by the result of previous step. The predictive performance of model was compared on the

**Table 1: Coefficient of determination by using stepwise regression**

Model	R	R <sup>2</sup>	Adjusted R <sup>2</sup>	Standard error of the estimate	Change statistics	
					R <sup>2</sup> Change	Durbin-Watson
1	0.872 <sup>a</sup>	0.760	0.755	138.699	0.760	
2	0.912 <sup>b</sup>	0.832	0.826	117.109	0.072	
3	0.916 <sup>c</sup>	0.839	0.827	116.741	0.007	1.527

a. Predictors: (Constant), area  
 b. Predictors: (Constant), area, max tem  
 c. Predictors: (Constant), area, max tem, rainfall, min tem  
 d. Dependent Variable: yield

**Table 2: ANOVA of stepwise regression analysis of oilseed crops yield as dependent variable and weather parameters as independent variables**

ANOVA						
Model		Sum of squares	Degree of freedom	Mean square	F	Significance
1	Regression	3347450	1	3347450	174.006	.000b
	Residual	1058064	55	19237.53		
	Total	4405514	56			
2	Regression	3664927	2	1832463	133.614	.000c
	Residual	740587.1	54	13714.58		
	Total	4405514	56			
3	Regression	3696836	4	924208.9	67.815	.000d
	Residual	708678	52	13628.42		
	Total	4405514	56			

*A: Dependent Variable: yield, b: Predictors: (Constant), area, c: Predictors: (Constant), area, max tem, d: Predictors: (Constant), area, max tem, rainfall, min tem*

**Table 3: Stepwise regression coefficients of grain yield as dependent variable and other traits as independent variables**

Model		Unstandardized coefficients		Standardized coefficients	t	p
		$\beta$	SE	$\beta$		
1	(Constant)	-22.666	61.465		-.369	.714
	Area	165.651	12.558	.872		
2	(Constant)	-7414.838	1537.287		-4.823	.000
	Area	129.487	12.997	.681		
	Max tem	256.549	53.322	.329		
3	(Constant)	-8401.645	1889.266		-4.447	.000
	Area	131.417	13.516	.692		
	Max tem	367.408	92.565	.471		
	Min tem	-127.818	83.632	-.162		
	Rainfall	.162	.187	.063		

basis of adjusted  $R^2$  and root mean square errors (RMSE).

**RESULTS AND DISCUSSION**

In this study we were found the predictive accuracies of four models by stepwise regression method, in terms of present deviation of the estimated yield and observed yield. In the table No. 2, all the models were statistically significant as predictor of crop yield but in table no. 1, the standard error of estimated yields were large for model 1 and 2, small for model 3. There we were also found that model 3 with highest  $R^2$  (.839) and model 2 with next higher  $R^2$  (0.832) than model 4, hence model 1 and 2 are not suitable for oilseeds yield estimation.

In the Table 3, Adding the additional weather variable to Model 2 increased  $R^2$  but did not increase the predictive accuracy of Model expressed as percent deviations of the estimated yield from observed yields as compared to Model 3. Hence adding more variable (min. temperature and rainfall) in Model 2, increased predictive accuracy for operational forecasting purpose. Based on the estimated coefficients for the Model 3 which are shown in Table 3, the equations of Model 3 are given below,

**Model 3**

$$\text{Yield}_{\text{est}} = 8401.645 + 131.417 \text{ area} + .162 \text{ rainfall} - 127.818 \text{ min temp} + 367.408 \text{ max temp}$$

**CONCLUSIONS**

In this paper we used stepwise linear regressions to built forecasting model for the prediction of yield of rapeseed mustered oilseed crops. Based on the output from SPSS 20.0, there are three model was built. By comparing three models using SPSS 20.0, Model 3 is a better model fits to the data than Model 1, and 2. This is because the value of  $R^2$  and adjusted  $R^2$  in Model 3 ( $R^2 = .839$  and adjusted  $R^2 = 0.827$ ) is higher than other models. In the stepwise regression method shows that adding more weather variables increased the prediction accuracy for forecasting rapeseed and mustered crops yield.

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## **Present Status of Monetary Compensation to the Victims of Agricultural Accidents in Punjab**

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### **ABSTRACT**

*The Government of Punjab is providing monetary compensation since 1984 to the victims of agricultural accidents through Punjab State Marketing Board. The compensation rate, fixed at ₹12,000/- in case of loss of life, was revised regularly to ₹2,00,000 at present. Monetary compensation amounting to about Rupees 8.3 million is being provided to more than 1800 agricultural accidents victims per year of Punjab state. Chaff cutter (34.7 per cent), threshers and harvesters (21.2 per cent), snake bites (7.9 per cent), electrocutions at tube-well motors (6.8 per cent), poisoning due to pesticides (7.0 per cent), tractors (3.0 per cent are involved in agricultural accidents resulting to death (32.1 per cent) or permanent physical injury to the victims (67.9 per cent). All the recorded agricultural accidents related to snake bites, electric motors and pesticides were fatal in nature. All the chaff cutter and thresher related accidents were non-fatal in nature resulting into amputation injuries of fingers (67.5 per cent), hands (18.2 per cent) and arms (10.5 per cent). Interventions are needed for creating awareness and development of safety devices and gadgets so as to reduce agricultural accidents. Similar monetary compensation scheme may be adopted by other states, so that agricultural accidents victims may be rehabilitated.*

### **Keywords**

Agricultural accidents, agricultural machinery, monetary compensation, rehabilitation scheme, safety

### **JEL Codes**

E65, I18, I19, I31, I38

### **INTRODUCTION**

Green revolution is the main factor responsible for the increase in importance of agriculture sector in the development of economy of the country. Nearly half of the Indian population is dependent on agriculture and allied activities for livelihood. In 2015-16, agriculture contributed 17.4 per cent to Indian GDP. During the past five years agriculture sector has witnessed spectacular advances in the production and productivity of food grains, oilseeds, commercial crops, fruits, vegetables, food grains, poultry and dairy. As per the Second Advance Estimates for 2015-16, the food grains production in India is estimated as 253.16 million tonnes (Anonymous, 2016). More changes have occurred in agriculture during the last five decades and increasing use of farm machinery is one of the examples. Presently tractors in Indian agriculture are about 6.12 million with addition of about 0.51 million each year (Anonymous, 2015). Farm mechanization along with increased application of other agricultural inputs such as

seeds; pump sets, fertilizers, pesticides, etc. have enhanced the productivity and production on the farms. But on the other hand accidents and casualties in the agricultural sector have increased tremendously. Gite (2003) estimated that numbers of agricultural accidents per year are to the tune of 1.31 lakhs in Madhya Pradesh, Orissa, Tamil Nadu and Punjab states alone resulting fatalities in 7.9 per cent cases and injuries in remaining cases. Loss of human life brings sorrow to the victim's family and to the society in addition to causing considerable financial loss to the country as whole. Most of the workers in Indian agriculture are in unorganized sector and, therefore, accidents and safety don't get much importance either at farm level or at organizational level. Though nationwide efforts are being made to minimize accidents, yet it is not possible to completely eliminate them. Another effort towards this direction is to provide monetary relief for rehabilitation of agricultural accidents victims. Punjab state has taken a lead in this direction by providing blanket insurance coverage to

all concerned engaged in agriculture at any time during the year. This social welfare scheme has been widely appreciated all over the country and some other states have also started adopting the similar schemes. However, there is a serious need for making an effort for adoption of similar rehabilitation scheme to agricultural accidents victims all over India. Keeping the above in view, it was planned to collect data of monetary compensation provided through Punjab State Marketing Board to the victims of agricultural accidents in Punjab state. This data is very useful to know about involvement of farm machines in agricultural accidents and resulting injuries.

#### REVIEW OF LITERATURE

Mohan & Patel (1992) studied main causes of injuries among farmers in the nine villages in the state of Haryana. Out of total 2164 injuries, 75 per cent victims were male. Forty six per cent of injuries were minor and that during use of hand tools. Threshers, chaff cutters, tractors and bullock carts were the main equipment involved in major accidents. As per their estimate the agriculture related accidents resulted in 5000 to 10000 deaths, 15000 to 20000 amputations and 15000 to 20000 serious injuries in the state of Haryana, Punjab and Uttar Pradesh alone.

Mittal *et al.* (1996) reported 36 accidents in a year from 12 villages of Punjab state. About 47 per cent of agricultural accidents were due to sprayers/pesticides, 25 per cent due to tractors, 14 per cent due to electric motors and 8 per cent each due to chaff cutters and threshers. The accidents incidence rate per thousand machines was highest in case of tractors (23.7) followed by sprayers/pesticides (15.5), electric motors (7.1), threshers (5.7) and chaff cutters (2.2). The proportion of fatal, major and minor accidents was 8 per cent, 36 per cent and 56 per cent respectively.

Tiwari *et al.* (2001) reported that tractors were involved in 46 per cent of total agricultural accidents resulting into 43 per cent of total fatalities. He estimated that there might have been about 6500 tractor accidents in Madhya Pradesh and Chhattisgarh states during a year causing death of 900 and injuries to about 7000 workers.

Anonymous (2002) reported that in Punjab, accidents by related to spray-pump and pesticides was the highest (21 per cent), followed by chaff cutter (18 per cent), tractors and implements (17 per cent), electric motor (8 per cent), thresher (7 per cent), bullock cart (2 per cent), sugarcane crushers and diesel engines (1 per cent each). Other agricultural accidents were related to snakes (12 per cent), wells (7 per cent), overhead electric wires (4 per cent), etc. It was estimated for 5567 agricultural accidents in Punjab causing deaths of 1232 and injuries to 4335 workers every year. The resulted total equivalent monetary loss due to agricultural accidents in the state of Punjab was estimated as ₹71 crores per year.

Tiwari *et al.* (2002) reported that 77.6 per cent of all incidents were due to farm machinery, 11.8 per cent were due to hand tools, and the remaining 10.6 per cent were due to other sources like snakes, wells, etc. Annual

estimate was given for about 17480 agricultural accidents in Madhya Pradesh causing death to about 2050 workers and injuries to 16770 workers. Total monetary loss due to agricultural injuries in the state of Madhya Pradesh was estimated as US \$27 million per year. Gite *et al.* (2004) estimated that each year there would be approximately 6450 tractor-related accidents, resulting in 550 fatalities and 6450 injuries to workers in Central India.

Kathirvel *et al.* (2004) found that 4.3 per cent of agricultural accidents were fatal, mostly during use of tractors, cane crushers, threshers, chaff cutters, open wells and pesticide use. About 77 per cent of agricultural accidents were related to farm machinery; 10 per cent to hand tools and 13 per cent to others.

Patel *et al.* (2010) studied agricultural accidents in the Etawah district of Uttar Pradesh in India. The monetary loss due to agricultural injuries in the study area was estimated to be about US \$0.73 million per year. These estimates reflect the seriousness of the situation and emphasize the importance needed to be given to Human engineering and safety aspects (Ergonomics) in agriculture.

#### METHODOLOGY

The Government of Punjab under section 26(xvii) of the Punjab Agricultural Produce Markets Act, 1961 started monetary compensation to the victims of agricultural accidents through Punjab State Marketing Board. It provides financial help to all the farmers, their family members, agricultural labourers and marketing committee workers while working on agricultural machinery and implements like threshers, tractor, trolleys, chaff cutters, spray pumps, etc.; digging of wells or electrocution while operating tube wells; using pesticides or due to snake bite in the field. All accidents happening during agricultural operations in field or at farm house or in registered marketing committee or during transportation of agricultural produce are covered under this scheme. However, only those agricultural accidents are covered by the Board that result into death or permanent injury to the victims.

The Punjab State Marketing Board has 153 Agricultural Produce Market Committees in Punjab with its headquarter in Chandigarh. A well-documented file of each monetary relief case is available with individual committee spread over the entire state. As it was not feasible to visit each and every market committee office and to scrutinise each of the accident case file for desired information, a performa was devised and help was sought from the head office of the Marketing Board. The performa included information about address of victim, machinery involved, cause of accident, injury sustained and amount of compensation provided. The data was collected and analysed for three consecutive years so as to have a fair average for the entire state.

#### RESULTS AND DISCUSSION

The monetary compensation was started by the Punjab Govt. in 1984 through Punjab State Marketing Board. The

compensation rate, fixed at ₹12,000 in the case of loss of life, was revised regularly to ₹2,00,000 at present (Table 1). The monetary compensation amount in case of loss of limb was also revised accordingly. Also a new category of injury was introduced in year 2011. The victims of agricultural accidents who suffered disability of body parts more than 25 per cent were given compensation varying between ₹50,000 to ₹1,00,000.

A total of 5492 agricultural accident victims of the State were given monetary compensation over a period of 3 years by Punjab State Marketing Board. The corresponding compensation amount totalled to about Rupees 250 million (Table 2). Thus; on annual basis, an average of 1831 agricultural victims were provided monetary relief amounting to a total of about 8.3 million Rupees. Among the various districts of Punjab State, SAS Nagar topped (721) in the list of number of accidents provided with monetary compensation, followed by Faridkot (622), Bathinda (506), Ferozepur(478), Jalandhar (411), SBS Nagar (369), Ludhiana (319), Kapurthala (293) and so on. These 8 districts of Punjab State covered about two-third (67.7 per cent) of the total agricultural accidents for compensation. These districts are, in fact, bigger in size and have more rural population as compared to remaining districts of Punjab State.

Among the various agricultural machines involved in accidents resulting to death or permanent physical injury to the victims, the chaff cutter topped among all (34.7 per cent). Threshers, combine harvesters and straw reapers were found to be involved in 21.2 per cent of total agricultural accidents (Figure 1). While, snake bites were recorded in 7.9 per cent accidents, electrocutions at tube-well motors resulted in 6.8 per cent accidents. Poisoning due to spray of pesticides by spray pump or any other mean resulted in 7.0 per cent of agricultural accidents. Tractors, while being operated alone or with trolley or with agricultural implements, were involved in 3.0 per cent of total agricultural accidents. The other agricultural operations and machinery were found to be involved in a few accident cases (3.0 per cent). Among a total of 5492

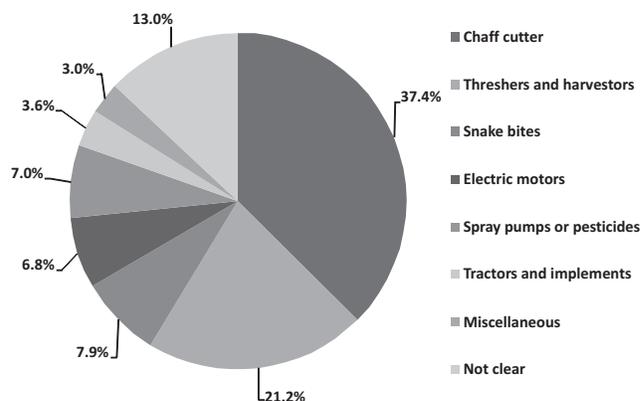


Figure 1: Magnitude of machinery involved in agricultural accidents

agricultural accidents, 714 cases were not clear as per filled performa received from various marketing committees.

A total of 1763 (32.1 per cent) agricultural accident cases were fatal i.e. leading to death of accident victims. Among all the known fatal agricultural accidents, snake bites were to the extent of 29.6 per cent (Figure 2), followed by poisoning due to pesticides (26.5 per cent), electrocution due to tube-well pumps and motors (25.8 per cent), tractors and implements (10.6 per cent) and miscellaneous (7.5 per cent). In fact, all the recorded agricultural accidents related to snake bites, electric motors and pesticides were fatal in nature.

Among the non-fatal agricultural accidents, the chaff cutters (61.9 per cent) topped the list (Figure 3), followed by threshers and combine harvesters (35.0 per cent), tractors and implements (1.4 per cent) and remaining (1.7 per cent). All the chaff cutter and thresher related accidents were non-fatal in nature resulting into amputation injuries of fingers (67.5 per cent), hands (18.2 per cent) and arms (10.5 per cent). Other non-fatal injuries included fracture, loss of eye sight, facial disfiguring, burn injury, etc. and were to be extent of 3.8 per cent only

Table 1. Rates of monetary compensation by Punjab State Marketing Board

Type of injury	Rate of monetary compensation (₹) w.e.f.					
	1.4.1984	1.4.1989	1.4.1996	1.4.2001	1.11.2007	29.03.2011
Loss of life	12,000	30,000	50,000	75,000	1,00,000	2,00,000
Loss of one limb or equivalent serious injury	5,000	12,000	20,000	30,000	40,000	40,000
Loss of two limbs or equivalent serious injury	7,000	20,000	30,000	45,000	60,000	60,000
Loss of finger or equivalent amputation	1,000	3,000	5,000	7,500	10,000	10,000
Loss of four fingers or equivalent amputation of	5,000	12,000	20,000	30,000	40,000	40,000
Disability (>25 per cent) of body parts	-	-	-	-	-	50,000-1,00,000

Table 2. District wise agricultural accidents provided with monetary compensation for three years period

District	Accidents related to								Total accidents	Fatal accidents	Total compensation amount in million ₹
	Chaff cutters	Threshers and harvesters	Snake bites	Electric motors	Spray pumps or pesticides	Tractors and implements	Not clear	Misc.			
Amritsar	174	22	0	0	0	0	0	9	205	2	5.858
Barnala	0	0	0	0	0	0	189	0	189	72	9.787
Bathinda	206	55	62	45	45	14	68	11	506	174	22.185
Faridkot	185	210	54	41	44	28	31	29	622	57	7.988
Fatehgarh Sahib	101	30	45	33	4	10	36	2	261	34	5.813
Ferozpur	175	127	42	26	39	9	13	47	478	219	30.225
Gurdaspur	24	3	13	12	7	2	13	1	75	129	14.890
Hoshiarpur	87	61	10	8	8	6	5	42	227	11	2.775
Jalandhar	159	44	54	51	31	11	39	22	411	13	3.783
Kapurthala	77	61	21	12	33	8	72	9	293	33	4.575
Ludhiana	114	95	28	20	20	10	18	14	319	42	9.222
Mansa	43	5	7	5	7	3	4	10	84	145	19.512
Moga	70	19	9	11	12	7	12	16	156	114	13.710
Muktsar	36	41	12	8	6	6	86	5	200	117	15.508
Patiala	61	4	10	7	18	4	4	16	124	114	17.530
Rupnagar	55	4	8	8	10	3	2	6	96	29	5.080
Sangrur	58	6	3	1	7	9	1	4	89	205	29.127
SAS Nagar	291	154	33	26	42	18	44	113	721	22	3.740
SBS Nagar	112	129	12	4	52	10	46	4	369	22	3.730
Tarn Taran	25	10	9	8	2	11	1	1	67	209	24.908
Total	2053	1163	432	376	387	200	714	167	5492	1763	249.943
Fatal cases	0	0	432	376	387	154	304	110	1763		
Non-fatal cases	2053	1163	0	0	0	46	410	57	3729		

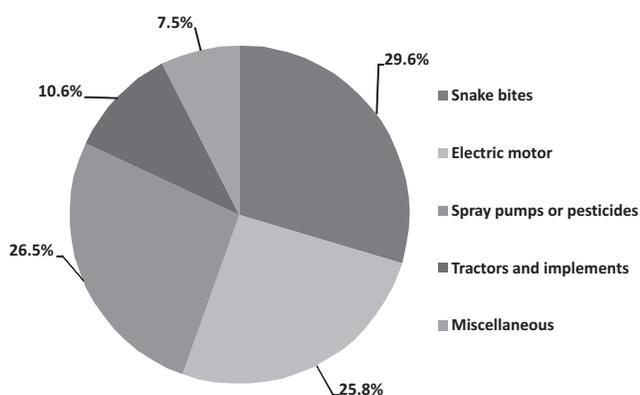


Figure 2: Magnitude of fatal agricultural accidents

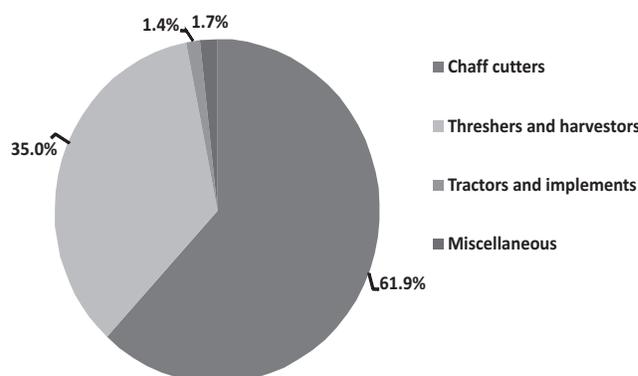
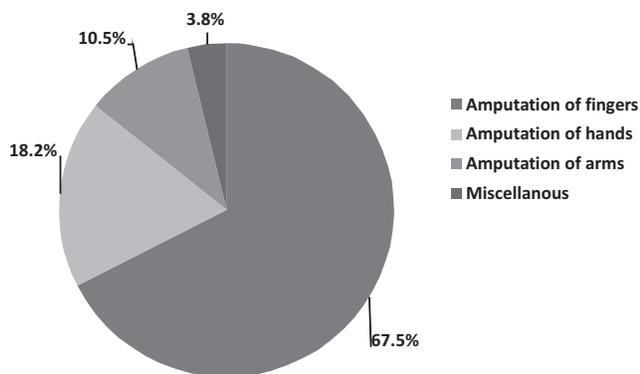


Figure 3: Magnitude of non-fatal agricultural accidents

(Figure 4).

The main causes of agricultural accidents involving chaff cutters and threshers were identified as sleeplessness, restlessness, carelessness, loose garments or hairs, lack of knowledge or experience, underage, lack of safety devices viz. safe feeding chute, flywheel lock, etc. Accidents with combine harvesters and straw reapers

happened due to lack of knowledge or experience, limited visibility, large size, over speed, sleeplessness, etc. Causes of tractor related accidents were overload, over speed, lack of knowledge or experience, carelessness and improper maintenance of machinery. Accidents involving tractor operated implements like cultivators, planters, etc. were specified mainly due to sudden breakdown of



**Figure 4: Nature of injury sustained by victims of agricultural accidents**

machinery, carelessness of driver or person assisting him. Pesticides poisoning happened mainly due to wrong practices during use of spray pumps viz. spray against wind, use of lethal and overdose of chemicals, no use of safety masks, etc. Accidents involving wells or tube-wells were specified mainly due to unlined well, presence of poisonous gases in wells during rainy season, slippery floor, etc. Electrocution accidents at pump-sets and motors were mainly due to uncovered or live wires, short circuit, lack of knowledge, improper lighting, wrong connection or practices. Accidents involving snake happened due to walking barefoot in field, sudden appearance of snake and carelessness.

#### CONCLUSIONS

Punjab Government through its Punjab State Marketing Board is providing monetary compensation amounting to about Rupees 8.3 million to more than 1800 agricultural accidents victims per year. Interventions are needed for creating awareness and development of safety devices and gadgets during use of the chaff cutters, threshers, combine harvesters, tractors, trolleys, spraying, tube-wells, pump-sets motors, snake bites, etc. Similar

monetary compensation scheme may be adopted by other states, so that agricultural accidents victims may be rehabilitated.

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## **Rehabilitation and Monetary Compensation Policy for Agricultural Accidents Victims**

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### **ABSTRACT**

*Estimates of agricultural accidents in states like Punjab, Haryana, Uttar Pradesh, Madhya Pradesh, Tamil Nadu, etc. present a very alarming situation. Punjab State took a lead for rehabilitation of accident victims by providing monetary compensation. Compensation policy was started in 1984 through Punjab State Marketing Board. No insurance premium is collected from anyone covered under the rehabilitation scheme. The monetary relief at the start was fixed at ₹2,000 in the case of death and was revised regularly to of ₹2,00,000 at present. About 1900 agricultural accidents victims are provided monetary relief with total expenditure within Rupees 100 million. The application procedure for the victims to avail benefit of this scheme is also simple. This social welfare scheme has been widely appreciated and adopted by a few other states. It is recommended that a similar procedure should be adopted all over the country and also a mechanism should be setup so that the amount of monetary relief depending upon injury level is revised with time.*

### **Keywords**

Agricultural accidents, agricultural machinery, monetary compensation policy, rehabilitation scheme, safety

### **JEL Codes**

E52, I18, I19, I31, I38

### **Introduction**

Agriculture plays a vital role in employment generation in the Indian economy, with nearly half of the Indian population being dependent on agriculture and allied activities for livelihood. As per the National Sample Survey Office, in 2011-12, the share of agriculture in employment was 48.9 percent. In 2015-16, agriculture contributed 17.4 percent to India's Gross Domestic Product (Anonymous, 2016). In India, the numbers of cultivators are about 118.8 million along with 144.3 million agricultural labourers. More changes have occurred in agriculture during the last five decades and increasing use of farm machinery is one of the examples. Presently tractors in Indian agriculture are about 6.12 million with addition of about 0.51 million each year (Anonymous, 2015). Farm mechanization along with increased application of other agricultural inputs such as seeds, pump sets, fertilizers, pesticides, etc. have enhanced the productivity and production on the farms. But on the other hand accidents and causalities in the agricultural sector have increased tremendously.

### **Agricultural Accidents Scenario**

With the introduction of threshers in Indian agriculture, the importance of accidents and safety in agriculture came into the picture. Verma *et al.* (1976) reported about 1000 thresher accidents in the country. About 73 per cent of the accidents were due to human factors, 13 per cent due to machine factors and 14 per cent due to crop and other factors. Responding to the public uproar created due to these accidents, the Government of India enacted the (Anonymous, 1983) and made safe feeding chutes/feeding systems compulsory on power threshers. Mohan & Patel (1992) reported about 2164 injuries in nine villages of Haryana. As per estimate the agriculture related activities cause 5000 to 10000 deaths, 15000 to 20000 amputations and 15000 to 20000 serious injuries in the state of Haryana, Punjab and Uttar Pradesh alone. Anonymous (2002) reported that in Punjab, accidents by related to spray-pump and pesticides was the highest (21 per cent), followed by chaff cutter (18 per cent), tractors and implements (17 per cent), electric motor (8 per cent), thresher (7 per cent), bullock cart (2

per cent), sugarcane crushers and diesel engines (1 per cent each). Other agricultural accidents were related to snakes (12 per cent), wells (7 per cent), overhead electric wires (4 per cent), etc. It was estimated for 5567 agricultural accidents in Punjab causing deaths of 1232 and injuries to 4335 workers every year. The resulted total equivalent monetary loss due to agricultural accidents in the state of Punjab was estimated as ₹71 crores per year. Tiwari *et al.* (2001) reported that 77.6 per cent of all incidents were due to farm machinery, 11.8 per cent were due to hand tools, and the remaining 10.6 per cent were due to other sources like snakes, wells, etc. Annual estimate was given for about 17480 agricultural accidents in Madhya Pradesh causing death to about 2050 workers and injuries to 16770 workers. Total monetary loss due to agricultural injuries in the state of Madhya Pradesh was estimated as US \$27 million per year. Gite *et al.* (2004) estimated that each year there would be approximately 6450 tractor-related accidents, resulting in 550 fatalities and 6450 injuries to workers in Central India. Kathirvel *et al.* (2004) estimated about 94478 agricultural accidents in Tamil Nadu causing death of approximately 4128 workers and injuries to 90350 workers on annual basis. Patel *et al.* (2010) studied agricultural accidents in the Etawah district of Uttar Pradesh in India. The monetary loss due to agricultural injuries in the study area was estimated to be about US \$0.73 million per year. These estimates reflect the seriousness of the situation and emphasize the importance needed to be given to Human engineering and safety aspects (Ergonomics) in agriculture.

#### **Legislative Measures Against Agricultural Accidents**

A number of steps including legislations were taken with the objective to reduce agriculture related accidents and rehabilitation of victims and their family members. These legislative actions included:

- BIS standards for safety aspects of various agricultural machines,
- Dangerous Machines (Regulation) Act (1983),
- Rehabilitation and compensation to agricultural accident victims, etc.

Most of the workers in Indian agriculture are in unorganized sector and, therefore, accidents and safety don't get due importance either at farm level or at organizational level. Though nationwide efforts are being made to reduce accidents, yet it is not possible to totally eliminate them. Bureau of Indian Standards (BIS) formulated various standards for different farm machines which included drawings, specifications, materials, safety gadgets and procedures, etc. As an example IS 9020:2002 specifies safety requirements for power thresher, IS 15542:2005 for power operated chaff cutter, IS 15561:2005 for sugarcane crushers, among the agricultural machines. Following the safety standards while manufacturing, fabrication and use of the specified machines can definitely reduce agricultural accidents to a large extent. However, majority of agricultural accidents

are due to human factors viz. lack of awareness, lack of formal training, long working hours, restlessness, carelessness, fatigue, seasonal operations of agriculture, etc. Therefore, monetary relief for rehabilitation of agricultural accidents victims and their family members is justified beyond doubt. In 1983, the Indian Parliament passed DMRA to regulate dangerous machines with a view to securing the welfare of operator and for payment of compensation for the death or bodily injury suffered by any labourers while operating such machines. As per DMRA, the manufacturer was fixed responsibility for providing compensation to user in case of accidents due to manufacturing fault. The employer was also asked to take accident insurance policy for users. Further, this act covered only the power threshers and its implementation was lacking in different states of India. Punjab State took a lead for rehabilitation of accident victims by providing blanket insurance coverage to all concerned engaged in agriculture and marketing operations at any time during the year. This social welfare scheme has been widely appreciated all over the country and some other states have also adopted similar schemes.

#### **Rehabilitation Scheme for Agricultural Accidents Victims – Punjab Model**

Compensation policy was formulated and proposal was submitted way back in 1978 and monetary aid was started in 1984 through Punjab State Marketing Board.

#### **Policy**

The Government of Punjab through Punjab State Marketing Board formulated policy and procedural rules for providing monetary relief for rehabilitation of agricultural accidents victims. It defined in detail the various terms and procedures for the effective implementation of policy. Among the various rules and regulations, it also formulated a quantitative percentage of loss of earning capacity depending upon the injury (Table 1).

Punjab State Marketing Board provides financial help to all the farmers, their family members, agricultural labourers and marketing committee workers, while:

- Working on agricultural machinery and implements like threshers, tractor, trolleys, chaff cutters, spray pumps, etc. in field.
- Digging of wells or electrocution while operating tube wells on the farm.
- Using pesticides or due to snake bite in the field.
- Use of agricultural implements in the notified market committees in the state of Punjab.
- All accidents happening during agricultural operations in field or at farm house or in registered marketing committee or during transportation of agricultural produce to marketing committee.

Insurance scheme was started with collaboration of Insurance Company for coverage of accidents leading to death or disablement to agricultural workers. At the start, the policy was named as 'Compensation in case of

thresher accidents' and covered only threshers and chaff cutter. However, later on other agricultural accidents as stated above and also due to crop produce or lightning, etc. were included to cover the gaps. Punjab State Marketing Board is, thus, covering about 19.33 lakhs cultivators, 15.88 lakh agricultural labourers and also the family members of the cultivators in the Punjab state.

#### Economics Involved in Monetary Relief

No insurance premium is collected from anyone covered under the rehabilitation scheme. In fact, Punjab State Marketing Board has 145 principal (regulated) agricultural market committees and a large number of notified committees for facilitating sale and purchase of agricultural produce. A fee @ 2 per cent is collected for providing facilities for sale, purchase, storage and processing of agricultural produce. Besides, income is also generated by Punjab State Marketing Board through sale of plots/shops at market committees. The total annual income generated by the Marketing Board is about Rupees 500 crores at present. The fund collected is spent on various development schemes for the social welfare of the farmers and rural mass. The rehabilitation of victims

of agricultural accidents is one of these schemes. A budget of 5-10 lakhs is allocated to each of the principal committee to speed up the relief to victims. The monetary relief at the start was fixed at `12000 in the case of loss of life and was revised regularly to the maximum of `200000 at present. The monetary compensation amount in case of loss of limb was also revised accordingly. Also a new category of type of injury has been introduced in the year 2011. Monetary compensation is also provided to the victims of agricultural accidents who suffer internal injuries leading to disability (more than 25 per cent) of body parts (Table 2).

No budget limit is fixed for providing monetary relief to victims of Punjab state. In fact, all the genuine victims are provided relief as per recommended rate. About 1900 agricultural accidents victims of Punjab state were provided with the monetary relief during the recent time (Table 3). The amount of relief disbursed under this rehabilitation scheme was about ten crores annually.

#### Application Procedure

The victim, or the nearest successor in case of loss of life to victim, has to report in written about the accident to

**Table 1: Loss of earning capacity depending upon injury**

Description of injury	Loss of earning capacity (Per cent)
Loss of both hands or amputation at higher sites	100
Loss of a hand and a foot	100
Double amputation through leg or amputation through leg on one side and loss of other	100
Loss of sight such that victim is unable to perform any work	100
Very severe facial disfigurement	100
Absolute deafness	100
Amputation of upper or lower limbs depending upon its extent	10 - 45
Loss of one eye or its vision depending upon its extent	15 - 20
Loss of finger or its parts depending upon its extent	1 - 7

**Table 2: Rates of monetary compensation by Punjab State Marketing Board**

Type of injury	Rate of monetary compensation (₹) w.e.f.					
	1.4.1984	1.4.1989	1.4.1996	1.4.2001	1.11.2007	29.03.2011
Loss of life	12,000	30,000	50,000	75,000	1,00,000	2,00,000
Loss of one limb (hand, arm, leg, foot etc./ any other equivalent serious injury)	5,000	12,000	20,000	30,000	40,000	40,000
Loss of two limbs (hands, arms, legs, eyes, feet etc./ any other equivalent serious injury)	7,000	20,000	30,000	45,000	60,000	60,000
Loss of finger/ finger parts equivalent to amputation of complete one finger.	1,000	3,000	5,000	7,500	10,000	10,000
Loss of four fingers (equivalent to amputation of one body part)	5,000	12,000	20,000	30,000	40,000	40,000
Disability (>25%) of body parts	-	-	-	-	-	50,000-1,00,000

**Table 4: Rate of monetary compensation in the case of death of victims**

State	Nodal agency	Monetary compensation in case of death (₹)
Haryana	Haryana Marketing Board	50,0000
Karnataka	Karnataka State Agricultural Marketing Board	50,000
Punjab	Punjab State Marketing Board	2,00,000
Rajasthan	Rajasthan State Agricultural Marketing Board	1,00,000
Uttar Pradesh	State Agricultural Produce Marketing Board	50,000

**Table 3: Monetary relief by Punjab State Marketing Board**

Financial year	Number of victims	Amount disbursed (₹ in crores)
1998-1999	1438	2.51
1999-2000	1407	2.39
2000-2001	1539	2.37
2001-2002	1878	4.84
2002-2003	1750	5.04
2003-2004	1663	5.07
2004-2005	1830	5.16
2005-2006	1778	6.31
2006-2007	1818	5.83
2007-2008	1869	6.46
2008-2009	1902	7.39
2009-2010	1946	8.43
2010-2011	1934	8.67
2011-2012	1612	7.89
2012-2013	1425	6.87
2013-2014	865	9.78

Source: Punjab Mandi Board, Mohali

the nearest market committee office within 30 days of accident and submit duly verified prescribed application alongwith supporting documents immediately afterwards. The performa includes personal details of the victim, details of accident, nature and extent of injury, medical treatment, etc. The victim or family member has to submit a police report and a medical report. Death certificate needs to be enclosed in case of loss of life. The victim has to submit an affidavit certifying that monetary relief is not being sought from any other agency.

The application and necessary documents after being received in the office are verified confidentially by a three member committee consisting of i) Administrator or Chairman of the market committee, ii) Secretary of market committee, and iii) Assistant or Deputy District Mandi Officer. The monetary aid, after due approval, is distributed among victims at the earliest and without delay in the presence of some reputed persons of the area or competent officials of Marketing Board.

#### **Status of Rehabilitation Scheme for Agricultural Accident Victims in India**

The Punjab State Govt. took a lead in formulating and implementing monetary compensation scheme for rehabilitation of agricultural accidents victims and their family members. The procedures and amount were

revised as per need of time and various legal issues. Some other Indian States followed the Punjab Model and started providing monetary compensation to accident victims. A list of States providing monetary compensation is as given in Table 4.

#### **RECOMMENDATIONS**

Similar procedure should be adopted all over the country, so that agricultural accidents victims may be rehabilitated. A mechanism should be setup so that the amount of monetary relief depending upon injury level is revised with time.

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## A Methodological Pathway to Quantify Livelihood Security of the Farmers: A Confluence of Alfares and FAO Approach to Frame an Index

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### ABSTRACT

Doubling farmers' income by 2022 is a big challenge but to attain livelihood security (LS) is far bigger challenge because the research reveals that one-fourth of the world poor lives in 8 Indian states. So, a comprehensive 7 dimensional LS index was crafted with 77 indicators following Alfares and FAO approach. The superiority of Alfares methodological has been shown over 8 widely used existing approaches. By obtaining ordinal ranking from 32 judges, food security had got maximum weightage of 96.24, trailed by health, economic, educational, social, institutional and infrastructural security. Suggested index can be used worldwide with location specific modification.

### Keywords

Alfares, Alkire, FAO, farmer, index, livelihood security

### JEL Codes

### INTRODUCTION

Currently 'index' is used in number of ways e.g. sustainable livelihood index (DFID, 1999); livelihood vulnerability index (Hahn *et al.*, 2009); socioeconomic vulnerability index (Ahsan and Warner, 2014); agricultural development index (Pal *et al.*, 2015); agricultural marketing and farmer friendly reforms index (NITI Aayog, 2016); dairy progressiveness index (Kale *et al.*, 2016); global risks index (World Economic Forum, 2016) and it is worthless to mention that this list is endless. However, concrete methodology to develop index in simplistic, unsophisticated and refined compartment is deficient and sometimes it leads to some flaw. It may be justified by few examples: in Guilford (1954) method, C-scale values for rank 3 and 4 will be 6, for rank 5 and 6 will be 5 and so on. That means it gives equal weightage for rank 3 and 4 or in other way round methodology couldn't discriminate between the ranks precisely and in furtherance the researcher who wants to use this methodology always have to carry 'ranks corresponding to C-scale values chart' with them. Similarly, in Garrett (1979) methodology, for 7 dimension index, the possible weightage could be from 78 to 22 thus

for rank 1 in the index the weightage obtained will be 78 and not 100, additionally researchers have to carry Garrett ranking conversion table with them. The exceedingly publicized Alkire and Foster (2011) methodology of the Oxford Poverty and Human Development (OPHD), which divulged that over a quarter of populace living in acute poverty in the globe live in only eight Indian states; devised household level Multidimensional Poverty Index with 3 dimensions namely: education, health and living standards but the flaw in the methodology is that if a particular household has score  $\leq 1/3$ ; that household is dropped from the calculation of final index value. In another instance, Pal *et al.* (2015) applied Narain *et al.* (1991) methodology to quantify agricultural development index but authors faced obscurity because as per methodology the values of indices ought to be between 0 to 1, but while using it one value of the indices was found to be negative and that was specifically mentioned as the limitation of the study. Lal *et al.* (2016c) alluded that Indian agriculture is afflicted from 11 types of crises and in that situation doubling farmers' income by 2022 is a big challenge and if target is achieved livelihood security (LS) would be a good indicator for this.

Moreover, comprehensive rural LS index is scanty. So, the present investigation was conducted with the following two objectives:

- i) To divulge a methodological pathway to frame an index
- ii) To enlist comprehensive livelihood security dimensions and quantify its indicators.

**MATERIAL AND METHODS**

It must be articulated here that scale is used for qualitative fact e.g. resilience, perception (Lal et al., 2014; 2015; 2016b), while index is convergence of various dimension to a single measurement. There is diverse way to quantify index viz., Principal Component Analysis (PCA) approach was used to construct Dairy Progressiveness Index (DPI) having 20 indicators for 16 different categorized states of India (Kale et al., 2016). A part from developing index, PCA is also used for bringing scientific parsimony among variables (Lal et al., 2016a; 2016b). In Philippines, an index for a disaster-resilient coastal community was drafted using paired comparisons for the Analytic Hierarchy Process (AHP) (Orencio and Fujii, 2013). A part from this to select different dimensions and its indicators is a humongous challenge but few widely adopted methods are Delphi technique (Orencio and Fujii, 2013); judges ranking method and the review of literature method. Review of literature method has explicitly brought out that a holistic approach of sustainability assessment ought to include all the five dimensions of sustainability for constructing the sustainable livelihood index (SLI) i.e. human capital, natural capital, physical capital, financial capital and social capital (DFID, 1999). In the present manuscript review of literature method was used to pick the 7 broad dimensions of livelihood security (LS) index i.e., food security, economic security, health security, educational security, social security, institutional security and infrastructural security. To find out the weightage of different dimensions of LS ranks were taken from the judges (who were acquainted with the know-how). To take the responses, schedule containing these 7 indicators having rank 1 to 7 was sent or personally collected from 41 judges; out of which, 32 judges responded within the predetermined time duration. In the present manuscript ranks were changed into weightage by Alfares methodology (Alfares & Duffauaa, 2009), which was based on ordinal ranking i.e. cardinal weights in multi-criteria decision making. To determine the relationship in Alfares model between the slope ( $S_n$ ) and the number of criteria n, Alfares plotted the values of  $S_n$  and articulated a decreasing non-linear curve which recommended an inverse model slope  $S_n$  as a function of n. Applying least-squares regression to  $S_n$  versus n, Alfares obtained the subsequent model:

$$S_n = 3.19514 + \frac{37.75756}{n} = 3.19514 + \frac{37.75756}{7} = 8.58907$$

Therefore, for any set of n ranked dimensions of a

particular index (in the present manuscript n represents 7 dimensions of LS index), assuming a weight of 100 percent for the first-ranked (most imperative) factor, the percentage weight of a dimension ranked as r is given by:

$$W_{r,n} = 100 - S_n(r-1), \text{ or}$$

$$W_{r,n} = 100 - (3.19514 + 37.75756/n)(r-1), 1 \leq r \leq n, \text{ r and n are integer}$$

Alfares and Duffauaa proposed model (M1) consistently outperformed 4 other models viz., linear weights with fixed slope (M2) Stillwell et al. (1981); inverse or reciprocal weights (M3) Stillwell et al. (1981); centroid weights (M4) Barron (1992) and geometric weights (M5) Lootsma (1999) model. So, the paramount Model M1 is selected to represent the association between the rank and average weight for the present study.

**Normalizing the dimension scores and calculation of final LS index value**

In order to combine dimension of LS which had been based on different units of measurement, the scores were needed to be 'normalized' before combination, which means putting them on the same scale value. In this manuscript, scores for each dimension were calculated by the formula suggested by working paper of FAO water (Sullivan et al., 2006).

$$Z \text{ ind}_i = \frac{X_i - X_{\min}}{X_{\max} - X_{\min}}$$

Where,  $X_i$ ,  $X_{\max}$  and  $X_{\min}$  are the original values for dimension i, for the highest value, and for the lowest value respectively.

$Z \text{ ind}_i$  = Value of normalized indicator i

Sullivan et al., (2006) contemplated that the composite score of LS was calculated by multiplying the score of particular dimension by their respective weightage as suggested by

$$LS_j = \frac{\sum_{i=1}^n W_i Z \text{ ind}_i}{\sum_{i=1}^n W_i}$$

$LS_j$  = Livelihood security value of j respondent

$Z \text{ ind}_i$  = value of normalized indicator i for the j respondent

$\sum W_i$  = Summated value of weightage of all i indicator

The equation can be reiterated as:

$$LS_j = \frac{W_{fs} FS_j + W_{hs} HS_j + W_{es} ES_j + W_{eds} EDUS_j + W_{ss} SS_j + W_{is} IS_j + W_{infs} INFS_j}{W_{fs} + W_{hs} + W_{es} + W_{eds} + W_{ss} + W_{is} + W_{infs}}$$

Where:

FS= the food security Index value for respondent j; HS= the health security Index value for respondent j; ES= the economic security Index value for respondent j; EDUS= the educational security Index value for respondent j; SS= the social security Index value for

respondent j; IS= the institutional security Index value for respondent j; INFS= the infrastructural security Index value for respondent j

**RESULTS AND DISCUSSIONS**

Out of the 7 dimensions of LS (Table 1 and 2), food security had the maximum weightage of (96.24 with 11 indicators), trailed by health security (82.02 with 12 indicators), economic security (80.94 with 11 indicators), educational security (77.99 with 10 indicators), social security (65.91 with 13 indicators), institutional security (58.93 with 10 indicators) and infrastructural security (57.59 with 10 indicators). The magnificence of this

methodology is that weight of a dimension ranked as 1 is 100; so there is no loss of deserving value and additionally it can be used both for households or the household heads.

**Selection of Indicator statements and scoring pattern for measuring LS of farmers**

The statements representing each particular sub-indicator of livelihood security were selected by extensive review of literature. On the basis of suggestions given by the judges, the final selection of statements of each dimension was made. The scoring pattern for each indicator for Table 2 depends on the nature of the statement i.e. if the statement is based on Yes/No type; 1

**Table 1: The frequencies of ranks as given by 32 judges, W is weighted values for seven dimensions of LS by using cardinal weights in multi-criteria decision making based on ordinal ranking**

Rank	FS	ES	HS	EduS	SS	IS	InsS	W <sub>r,n</sub>
1	28	2	0	0	0	0	2	100.00
2	2	6	14	5	3	2	0	91.41
3	0	15	6	10	1	0	0	82.82
4	0	5	7	12	2	4	2	74.23
5	0	0	5	4	17	1	5	65.64
6	0	4	0	1	6	10	11	57.06
7	2	0	0	0	3	15	12	48.47
f	32	32	32	32	32	32	32	
W <sub>r,n</sub> f	3079.75	2590.18	2624.54	2495.70	2109.20	1842.94	1885.88	
1/f	0.03125	0.03125	0.03125	0.03125	0.03125	0.03125	0.03125	
W	96.24	80.94	82.02	77.99	65.91	57.59	58.93	

s<sub>n</sub>=3.19514+37.75756/7=8.589068571; M<sub>c</sub>(Mean of W)=70.565; Standard Error for M<sub>c</sub>=4.5432

**Table 2: Indicator statements for measuring livelihood security (LS) of farmers**

Security Component	Indicator	Response from farmer
<b>Food Security</b>	1. Number of meals taken by all the members in a family per day	Males- Females- Children-
	2. Staple food in any kind is available to you throughout the year (If yes, please specify)	Yes No
	3. Clean water is used for cooking purpose (Example- Iron free water)	Yes/No
	4. Whether any of the family members are suffering from malnutrition □	Yes/No
	5. Food items consumed by the family and the concerned quantity (in g/day)	Vegetarian Items I. Cereals II. Pulses III. Oil/Fats iv. Vegetables v. Green leafy vegetables vi. Milk vii. Sugar/Jaggery viii. Roots/Tubers Non-Veg. Items i. Egg ii. Fish iii. Meat iv. Chicken

Cont...

	6. Percentage of food items consumption, produced by own	
	7. Do women of the family skip any meal <input type="checkbox"/>	Yes/No
	8. Is there any special diet for pregnant women/ children in the family <input type="checkbox"/>	Yes/No
	9. Whether there is enough food stock for at least one week <input type="checkbox"/>	Yes/No
	10. Availability of Public Distribution System (PDS)	Yes/No
	11. In case of natural calamity, availability of the food supply from Govt., NGO etc.	Yes/No
<b>Economic Security</b>	1. No. of earning members in the family	
	2. No. of enterprises in which household members are engaged	
	3. Annual household income of all the earning member of the family (in )	
	4. Current value of savings/debt the household	
	5. Availability of employment during lean period (including type of employment)	Yes/No
	6. Percent of income spent on non-farm/off-farm activities	
	7. Availability of credit through Kissan Credit Card (KCC)	Yes/No
	8. Repayment of credit	Yes/No
	9. Do you have farm insurance <input type="checkbox"/>	
	10. Have you sold any assets to meet household expenditure in distress <input type="checkbox"/>	Yes/No
	11. Household assets (Land, Livestock, House, Agri. Implement, Radio, Cycle/Bike, TV, Mobile, Any other)	Please specify
<b>Health Security</b>	1. Incidence of disease at household, village and community level	Yes/No, If Yes Please specify
	2. Average number of days of sickness during last year	At individual and household level
	3. Availability of medical treatment in case of emergency and mode of transport	
	4. Vaccination for major diseases (like DPT, Polio, Hepatitis etc) for children (0-5 years)	
	5. Availability of Primary Health Centre (If Yes, Specify distance from your home)	
	6. Health insurance for your family is done	
	7. Infant mortality in the family	Yes/No
	8. Family member wash hands with soap before meal and after toilet	Yes/No
	9. Addition of alcohol/ tobacco	
	10. Availability of Anganwadi/ASHA workers	
	11. Whether women get the dose of tetanus after delivery of a new born <input type="checkbox"/>	
	12. Body Mass Index (BMI) of the family members (BMI is proper/improper)	(Data of weight and height will be taken)
<b>Educational Security</b>	1. Family educational status	
	2. Children are going to school or not <input type="checkbox"/>	
	3. Children are getting quality education in the school	
	4. Higher education for your children is affordable to you	
	5. You have limited access to information regarding your children education	
	6. Your children are sent to distance places as educational facilities are not available in your native place <input type="checkbox"/>	
	6. Women's literacy level of the family	
	7. Whether any of your family members is school/college dropout <input type="checkbox"/>	
	8. Your children school is covered under mid-day meal scheme <input type="checkbox"/>	
	9. Do you read any farm magazine <input type="checkbox"/>	
	10. Having Computer proficiency to any family member <input type="checkbox"/>	

Cont...

<b>Social Security</b>	1. Membership in any co-operatives, SHGs, farmers' association etc.	Yes/No
	2. Interaction with key informants/ progressive farmers	Regular/often/sometimes/ never
	3. Do you participate in Krishi/Dairy mela <input type="checkbox"/>	
	4. Contacts with Sarpanch/Agri. Officers etc.	
	5. In case of any family/social conflict, you solve the problem among yourselves	
	6. Availability of police station in the village /locality/taluka	
	7. Whether different facilities/schemes given by the Govt. for the benefit of farmers are reaching to the farmers <input type="checkbox"/>	Yes/No
	8. Awareness about one's right to utilize/access public resources	
	9. Govt. has implemented/implementing different programmes in your locality	
	10. There are harmonious relationship among social castes/religions	
	11. Have you ever faced any discrimination by govt. officials (due to your caste/creed) <input type="checkbox"/>	
	12. Women in your locality is safe	
	13. Have you won award/recognition for your extra-ordinary performance in Agriculture <input type="checkbox"/>	
<b>Institutional Security</b>	1. No. of training programme conducted for the farmers by the nearby KVKs/NGOs	
	2. Women of the family is the member of SHG/Co-operative	
	3. Is there any post office in your locality	
	4. Is there any bank in your locality	
	5. Availability of civil society in the locality	
	6. Availability of hospitals in the locality	
	7. Availability of structured market in the village/locality/taluka	
	8. Help from gram panchayat	
	9. Need-based support provided by the nearby Agriculture colleges for the villagers	
	10. Whether you are getting any kind of institutional support to do your farm operations more scientifically and efficiently <input type="checkbox"/>	
<b>Infrastructural Security</b>	1. Electricity facility is available in village and farmers' access this facility	
	2. Good linkages of road from villages to the nearby cities/town	
	3. Availability of transport facilities like buses, truck, auto-rickshaws, railways	
	4. Location of market (inside/outside/far away from village) for selling the output	
	5. Water facilities such as lakes, ponds, rivers, irrigation canals etc. are available	
	6. Accessibility to mobiles/ means of telecommunication	
	7. Accessibility to internet	
	8. Availability of storing facilities in home/cold-storage <input type="checkbox"/>	
	9. Whether there is food processing industry in the nearby locality <input type="checkbox"/>	
	10. Whether there is structured/regulated market facility availability in your locality <input type="checkbox"/>	

mark would be rewarded to Yes and 0 for No and for reverse coded it is vice versa; for percentage based statement scoring pattern would be 1 (<50%), 2 (50-75%) and 3 (>75%). To convert the food taken by the respondents to the Kilo-calorie value 'dietary guidelines for Indians' prescribed by National Institute of Nutrition (2011) was followed.

## CONCLUSIONS

In the present manuscript a methodological pathway to quantify livelihood security of the farmers by confluence of Alfares and FAO approach is suggested. A rural livelihood security index had been developed for assessing the livelihood security status among farmers. The supremacy of Alfares methodology has been

established over 8 widely used existing approaches. Government of India wants to double farmers' income by 2022 is a gigantic challenge but it is goal and can be attained by proper developmental framework. But, the ultimate aim is to ensure livelihood security (LS) for the farmers because it is far bigger challenge. So, a comprehensive 7 dimensional LS index was crafted with 77 indicators following Alfares and FAO approach. Through, relevant literature scan and consultation with experts 77 indicators had been selected under 7 dimensions. Alfares approach can be used for any number of judges but examples from 32 judges have been illustrated in the methodology and the magnificence of this technique is that weight of a *dimension* ranked as 1 is 100; so there is no loss of deserving value. By obtaining ordinal ranking, food security had got maximum weightage, followed by health, economic, educational, social, institutional and infrastructural security. Manuscript concluded by proposing recommendations to use rural LS index worldwide with location specific modification.

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